Text cut off in original

An Investigation into the Use of CD-ROM Technology

by pupils in

Mainstream Primary Schools

A thesis submitted to Middlesex University
in partial fulfilment of the requirements for the degree of
Master of Philosophy

Ann McDevitt

School of Lifelong Learning and Education

Middlesex University

June 1998

Abstract

The 1994 CD-ROM in Primary schools government initiative increased by over two thousand, the number of primary schools who were using CD-ROM technology with their pupils. The investigation focuses of the way that this technology was being introduced, and later used, in four schools in two English shire counties. The findings are compared and contrasted with the results from a postal survey of primary schools, with postal addresses in the same two counties, who received a complete CD-ROM system under that 1994 government initiative as well as the findings of other researchers of the same initiative.

The investigation focuses on the organisation and management of the CD-ROM system within the school. The advantages and disadvantages of siting decisions are examined along with the resulting effects upon pupils' use of the system. As the government initiative provided schools with both a system and a package of CD-ROM software, the investigation looks at the titles that proved most (and least) popular with schools. Since very few CD-ROMs were developed for education, teachers' criteria for choosing commercial CD-ROMs to use within the National Curriculum are examined as are the purchasing policies and the decision making processes of the four schools.

Having observed the way in which the technology was introduced to pupils in the four schools, the investigation was continued to observe the pattern of use that developed and the way in which that use changed through the primary age range. Although the use by young pupils continued to include multimedia reading books, once pupils had learnt simple ordering skills, they were introduced to the use of CD-ROMs for information collection; eventually using CD-ROMs almost exclusively to supplement, rather than supplant, traditional information sources. Teachers recognised that CD-ROMs contained vast sources of information but that pupils required search skills in order to access that information. The ways in which teachers attempted to teach these skills using the CD-ROMs that were available to them were investigated. Although standard referencing methods enabled pupils to find information in books using, the task was different, and often more difficult with CD-ROMs, due to the non-standard organisations of the titles that were designed for the home market and leisured browsing. The investigation looked at the ways in which pupils in the four schools were guided to find information and the ways in which that information was recorded and used within the curriculum. This was compared with the use of traditional source

When CD-ROM technology was introduced into education, it had been expected to make changes both to the delivery of the curriculum and the ways in which pupils both collected and recorded information. The investigation looked for these anticipated changes within the four schools. As two of the schools had units for hearing impaired pupils, the investigation included observation of the ways in which the technology was used by those pupils both within the units and the mainstream classes seeking to discover possible advantages and disadvantages that the use of the technology made for pupils who could not access all of the available media. However, unlike secondary pupils, it would appear from this research that the use of CD-ROM technology brought an additional option of information source for primary pupils, but made little change to the structure of the curriculum.

Contents

Figures

Tables

Chapter 1

Introduction

The researcher's interest in multimedia began when working as an LEA Advisory Teacher for IT for Hearing Impaired and Visually Impaired Children. One of the speakers at the 1990 NCET Conference 'Micros for Special Needs' showed examples of the multimedia storybooks he was developing for deaf children as part of a Government funded Interactive Video Project. Certainly, the graphics and sound were vastly superior to anything that was possible with the BBC computers used by most of his audience; however, what most impressed the researcher was the ability to present information in a variety of media, to suit the need of the individual, as well as the linkages between screens. This latter facility enabled children to move backwards and forwards through the story to obtain further information on vocabulary, facts etc. of which they were unsure - as well as just for the pure pleasure of enjoying favourite screens. The ability to obtain immediate access to explanatory pictures, simple captions or signs, at the press of a button, appeared to solve many of the difficulties encountered by both pupils and staff with whom the researcher was working. In addition, this new method of presenting information appeared to offer tremendous possibilities for many children, not only those with special needs. Unfortunately, the extremely high cost of the necessary hardware put this form of interactive video out of the reach of most schools. However, we were informed that improvements in technology, especially in data compression, were expected to make it possible for similar products to be made available on low cost standard compact discs 'in the near future'.

By the time this possibility became reality, changes in LEA funding meant that the researcher had become an independent IT Consultant, working with a broader range of pupils and schools in a number of LEAs. Regular updates from the National Council for Educational Technology (NCET) on changes in the technology convinced the researcher that multimedia technology would form an important part in the future educational use of IT. Thus when setting up her business, the researcher obtained

the necessary hardware and examples of software. Government funded schemes were already in place in the secondary sector, but a few primary schools were becoming interested it the possibilities of the technology. The recent introduction of Local Management of Schools (LMS) enabled Headteachers and Governors to allocate their funds with greater independence. Government encouragement of a 'market-led culture ' into the world of education may have fuelled their interest in emerging technologies when considering the purchase of new IT equipment. The researcher's interest in multimedia led her to work with such schools to introduce the use of this technology.

Concurrently, the researcher was a part-time lecturer in the School of Education at Middlesex University. The research focus of this department was moving towards multimedia technology in the latter part of 1993, and the researcher was asked to conduct a small research project into the use of CD-ROM technology in primary schools. This research was a case study of two primary schools who had recently introduced the technology, McDevitt (1994). Although not part of the current research, this acted as a pilot project for the researcher. The two schools involved in this pilot later became schools A and B of this current research.

Shortly after starting this project, the researcher was present at a meeting where the 1994 CD-ROM in Primary Schools Initiative was announced. As explained in greater detail in chapter 2, this initiative provided many more primary schools with a multimedia system plus software. However, some months elapsed between the announcement of the initiative and the systems arriving in schools.

Although not involved with the dissemination of the CD-ROM in Primary Schools Initiative, this function being achieved using existing LEA services, a greater part of the researcher's work was, by then, involved with schools using multimedia and CD-ROM technology with a range of pupils, some with special needs. Some of these schools were recipients of systems under the initiative, whilst others, in the wake of

the publicity it had engendered, were embarking on the introduction of the technology using their own funds. In her work as an IT consultant, the researcher had become aware of possible advantages afforded by the use of multimedia technology to pupils with a range of special needs. She was also cognisant of possible disadvantages for pupils who were not able to access all the channels of communication offered by multimedia, yet who were integrated into mainstream schools. Such schools were, and still are, required to adhere to the National Curriculum and, in addition, extolled to achieve increasingly higher standards. However, what was happening, in practice, could not be adequately judged from occasional visits to schools made by the researcher as part of her work as an IT Consultant where it was usual to concentrate of the positive aspects of the technology. From her previous experience, the researcher considered that such questions might be better answered by a longer term, broader case study. This was made possible with help from Middlesex University Science and Technology Educational Research Project (STERP). This project ran from 1993-1996 and provided funding of university fees as well as the loan of equipment, both hardware and software, to assist the researcher in her investigation.

Having worked for many years in the field of special needs, the researcher was also concerned to discover what effect the use of the technology, and the changes in curriculum delivery that it produced, had for the education of such pupils. Since 'special needs' covers a very wide spectrum of learning, physical and sensory difficulties, the researcher decided to narrow the field to one group, namely hearing impaired pupils. This was the area of special needs which had initiated her interest in the use of multimedia and is also of personal interest; although not pre-lingually deaf, the researcher is now severely hearing impaired herself. The researcher was aware of aspects of multimedia technology that could be both of particular benefit, as well as presenting additional difficulty, for the hearing impaired. By examining the way that the technology was being used by such pupils both within mainstream classes and the specialised unit settings, the researcher hoped to discover how

potential difficulties were overcome, as well as the ways in which advantages afforded by the technology were used to improve pupils' access to the curriculum.

In essence, the researcher wanted to know the following and developed a range of research questions and subsidiary questions.

- ***how was CD-ROM technology being used in mainstream primary schools?***

  How and why was the use of CD-ROM technology initiated in the school?

  What equipment (hardware and software) was available?

  How, and by whom, were decisions made concerning purchase and use of equipment?

  Where and by whom was the technology used?

- ***which CD-ROMs were being used, and for what purposes?***

  How were pupils introduced to the use of CD-ROM technology?

  How did they learn the information-finding skills to use a CD-ROM effectively?

  How did the use of CD-ROMs change through the primary age range?

- ***what changes has the use of CD-ROMs in primary schools made***

  to the delivery of the curriculum?

  to the way in which pupils collected and recorded information?

Although these questions might be best addressed by a case study, if changes were to be observed, then the researcher considered that this study needed to continue for more than one school year. Since visits to the schools would need to made on a regular basis, the number of schools was limited to four. These schools were chosen from two different, but adjacent LEAs. In this way, the researcher hoped to avoid 'LEA-dependent' results. All four were mainstream schools, with pupils within the primary age range and had either already started, or shortly expected, to introduce CD-ROM technology into their schools. They were all considered to be examples of 'good

primary practice' but had a range of both experience and expertise in the use of IT, in general, and CD-ROM technology, in particular. In order to address the issues concerning hearing impaired pupils, two of the schools included Units for Hearing Impaired Pupils within their school buildings. To avoid differences in results due to communication methods used and/or levels of deafness of their pupils, both of these chosen units used the same method of communication (Total Communication) and included pupils with a very wide range of hearing impairment. Almost all of the hearing impaired pupils were integrated into the mainstream schools for part of the school day but the extent of their integration varied with the needs of the individual. Although their level of expertise varied, both Units were accustomed to using IT with their pupils and both expected to have multimedia systems within the Units in addition to that of the mainstream school. In this way, the researcher hoped to be able to compare and contrast the ways in which CD-ROM technology was used by these pupils within the Units and within the main schools.

The use of a postal survey of a large number of schools who were also using CD-ROM technology was considered desirable by the researcher. Since the number of schools in the case study was quite small, she felt it was important to be able to set any findings from those observations in a wider context. To obtain such information, the researcher needed to identify schools:-

- with pupils in the primary age range
- with at least one CD-ROM computer system
- that included a range of expertise and experience in the use of IT
- that included the two LEAs used for the case study schools.

As the LEAs of the case study schools were both large shire counties on the fringe of London, she decided to use as her sample group, all of the schools who had received a system under the 1994 DfE CD-ROM in Primary Schools Initiative with postal addresses that included the same two county names. This sample covered both the

two LEAs of the case study schools and a number of London boroughs. Information concerning the names, addresses and platform of system provided was obtained both from the LEAs directly or NCET. The postal survey was sent in the form of an A5 booklet to a named person, whenever possible. This booklet is included in Appendix 2 and is discussed in greater detail in Chapter 4. The researcher hoped to compare the information obtained from this survey with that of the case study observations. As the survey information represented a 'snapshot in time', it would not enhance the researcher's knowledge concerning changes that occurred both in the use of the technology and delivery of the curriculum. However, it was hoped that the results could be used to set the observations in the schools into a wider context, enable judgements to be made concerning how typical were both the schools and the uses of CD-ROM technology actually observed and mediate any extrapolations that were might be made from those observations.

Although all of the case study schools either already had, or shortly expected to have, multimedia computer systems, some were to be provided by either DfE Initiative or LEA provision. The anticipated start date for the case study had to be put back one term, to the start of the next school year, to allow for delays in the arrival of these systems. During this period, changes occurred both within the schools themselves and to the equipment available for the investigation.

In response to a perceived need, School A had set up a unit within the school, called the Booster Unit, for pupils who needed more individual help than could be provided within the mainstream classrooms, including pupils with learning difficulties as well as those of exceptional ability. Unlike the other two units, it had been set up by the school itself, and was not funded by the LEA. The researcher found this unexpected addition to the case study most helpful as it enabled her to not only compare the use of CD-ROMs within the school and the Booster Unit but also to compare the use of the technology between LEA and school funded units.

Unfortunately, when all the other systems had arrived, it became clear that the unit of school D would not, after all, receive a multimedia system. As explained in chapter 3, the use of an alternative school was considered. After much thought, the researcher decided to include school D in the case study since Middlesex University were able to lend a multimedia system to the unit. Although this loan system proved more limited in its use of CD-ROMs than anticipated, the researcher considered that she was still able to make useful observations of the way in which CD-ROM technology was being used within a specialist unit setting, although direct comparisons with the other case study schools were not possible, as detailed in chapters 5 and 6.

When the researcher embarked on the study, the primary curriculum was the subject of both debate and change. The researcher anticipated that the availability and widespread introduction of CD-ROM technology into primary schools would produce changes to both the curriculum itself and to its delivery. Such changes might affect the access to the curriculum of pupils with special needs. Thus, although the dissertation primarily concerns the introduction of CD-ROM technology to mainstream primary pupils, each chapter contains a section concerning aspects of particular relevance to hearing impaired pupils, as the researcher's chosen group of pupils with special needs. The only exception to this is in chapter four which concerns a government whole school initiative and where the presence, or absence, of pupils with special needs was not taken into account in either the selection of the schools or the hardware and software provided by that initiative.

Organisation of the dissertation

Following this introduction, chapter two of the dissertation examines the background literature to the research, concentrating on four main areas i.e. the initiatives that led to the introduction of CD-ROM technology into primary schools, the software used, the consequent curriculum changes and the implications of these preceding items for hearing impaired pupils.

Chapter three examines, in detail, the methodologies used by the researcher and the reasons for their choice, as well as the ways in which data was collected and checked. Following an examination of previous models used to explain the dissemination of an innovation, the researcher offers an adapted model to fit the innovation of CD-ROM technology into primary schools.

Chapter four provides a detailed analysis of the results of the postal survey and explains its relationship to the case study. These results from the survey are used in later chapters to compare and contrast with the findings from the case study.

Chapter five looks first in greater detail at the four schools chosen for the case study and then focuses on their general IT organisation. From this base, the chapter progresses to a more detailed examination of the way in which multimedia technology was being used by the four schools, in order to address the subsections of the first research question concerning how CD-ROM technology was being used in mainstream schools.

Chapter six focuses on the observations in the four case study schools. It is organised under the subsections of the second research question to address the issues concerning the CD-ROM titles being used and the purpose of such uses. However, the questions concerning the changes to the delivery of the curriculum brought about by the use of CD-ROM technology are also addressed in this chapter.

Each chapter concludes with a summary of findings. These are brought together in the final chapter where, following a brief discussion of the typicality of the schools, each of the research questions is addressed and summarised. On the basis of these findings, the dissertation concludes with a proposition for future uses of the technology within the primary school.

The dissertation contains a number of appendices. The glossary gives a brief explanation of the educational and information technology terms that are used throughout this dissertation. Appendix two provides copies of the postal survey booklets that were used. Details of the results of readability tests on the CD-ROM Encarta, plus an explanation of the tests used are contained in appendix three. The data recording tables and diagrams that were used for the observation of pupils are shown in appendix four. This is followed by an appendix (five) giving examples, from the cases study schools, of the information for staff concerning available CD-ROM titles. The final appendix (six) is an account of the use of CD-ROM technology by a pupil who is both hearing impaired and autistic. As the technology has been found to be of particular importance to this boy, appendix six enlarges on the information provided in chapter six.

Chapter 2

Background to the Research

The literature concerning the introduction of innovations into education tend to focus around the introduction of the innovation itself and the uses that are, or perhaps could be, made of it. This literature survey concentrates on four main areas issues:-

1. The Initiatives that led to the introduction of CD-ROM technology into primary schools

2. Software used by schools both to introduce and develop their use of CD-ROM technology.

3. Curriculum considerations; changes that the use of the technology made to the delivery of the National Curriculum.

4. Implications of the preceding three items for pupils with special needs, especially those with hearing impairment.

Literature concerning the use of IT in Education, in general, has not been included in this chapter, except where it pertains to the use of CD-ROM technology. The subject was considered too vast and often irrelevant to the aspect of IT under investigation.

However, before embarking on these discussions, it may be necessary to clarify some of the terms used. In this document the term **multimedia** is applied to a group of technologies where text, graphics, sound, animation and video can be combined in order to convey information; a key element of the multimedia concept is that it should be interactive. Unlike other forms of electronic communication, multimedia has the potential to combine its media types in a single neat package which can be controlled by a data processor. This may be a desktop computer running standard software or some specific consumer product such as interactive TV.

NCET (1993a) defines multimedia as follows:

> .....multimedia should include at least three of the following:
> - text
> - still images
> - computer graphics
> - animation
> - audio
> - moving pictures
>
> (NCET,1993a :2)

The use of CD-ROM technology represents just one aspect of multimedia technology, however the applications observed could all be described as 'multimedia activities' using the definition above. Heppell(1994) considered that the term described the possibility that a computer might be able to deliver all the elements that we take for granted in everyday life; speech, text, graphics, video, music, sound, data, and argued that the term 'integrated media' might have been a better word. However, he considered either term to only have validity whilst few computers had such capabilities and predicted the term to be consigned to become redundant within a few years. In a recent review of (non-portable) computer systems for schools, Vayne (1997) appears to confirm Heppell's contention that multimedia systems have now become the norm, rather than the exception. The systems under review were 'standard' systems as supplied to schools by the more prominent educational computer suppliers and all were multimedia-capable machines. Similarly, High Street suppliers of desktop computers to the home market are almost exclusively stocking machines with multimedia capabilities.

2.1 The Initiatives that led to the introduction of CD-ROM technology into primary schools

Although the impact of interactive multimedia in British schools appears to be very recent, in fact the DfE (as DTI and later the DES) have been funding projects on this subject since 1986. However, these early attempts relied on the use of 12" laserdiscs for the storage of the information. The very high cost of both the discs themselves and the technology to use them meant that although worthy, they had little impact on all but a few schools. Improvements in data compression technology and the rise

of the home CD-ROM market has resulted in the availability of the technology in a form that can be afforded by many more schools, especially when helped by DfE initiatives. Table 2.1 summarises the initiatives so far that are related to multimedia/CD-ROM technology.

The technology that enabled data to be stored on a 12cm CD-ROM disc for use in a computer became available in the late 1980s. However, the first uses of the technology were for large text-based databases such as the catalogues of periodicals or research papers that are used in higher education. The technology did not impinge upon schools until 1990 when some LEAs and secondary schools started to experiment with the use of more accessible, but still predominately text based information sources, such as encyclopaedias, newspapers. The results of some of these school based experiments with CD-ROM technology resulted in the publication, by NCET, of four booklets.

Seek and You will Find ...Fast (encyclopaedias on CD-ROM) Marshall (1991)
Using the news (newspapers [archives] on CD-ROM) Kenny (1991)
Searching effectively (NERIS on CD-ROM) Quigley (1991)
Finding the words (dictionaries on CD-ROM) Ordidge, Quigley, Waller (1992)

These were actually written between December 1990 and February 1991 for planned publication at Easter 1991. The booklets proved most timely, for in January 1991, the DfE announced a £500,000 pilot project for CD-ROM in schools. This was to assist LEAs in the purchase of CD-ROM drives plus discs and incorporated an evaluation of the pilot scheme. In practice, the four booklets were used both to assist NCET in the choice and schools in the use of the CD-ROM titles. Unlike later initiatives, the only hardware provided was the CD-ROM drive itself; schools taking part in this scheme needed to possess or to provide the necessary hardware to use that drive. This may explain why the pilot involved predominately secondary schools (523), although a few primary, middle and special (30) schools were also included. 78% of the drives were linked to PCs with the rest evenly spread between MAC and Acorn computers.

Table 2.1 A summary of government multimedia initiatives

Multimedia in Education

1986 -1988	Interactive Video In Schools project packages with videodisk, software and materials developed for trialling in 92 schools
1986	Doomsday Project 14,000 schools helped to produce The National Disc - data, text, photos - but used a different system AIV (advanced interactive video) from the other interactive video systems
1988	2 IV systems into every LEA and one to every teacher training establishment (BBC or Nimbus systems) - many chose the AIV system
1987-90	Interactive Video in FE - funding for a number of courseware packages plus MS-DOS computers linked to dual standard Laserdisc players
1986-91	Telsoft Project - low cost VHS videotape and BBC computer system - Telsoft IV Centre still operative
1990	Nat. Curric. Council commissioned 2 IV discs for primary and 3 for secondary to support Maths -World of Number. Primary discs use bar-code readers and TV or CD-ROM, secondary uses CD-ROM with MS-DOS computers
1993	Funding for a primary and a secondary system to every LEA + 12 GM schools
1991-93	CD-ROM in schools project . Drives and discs for 523 secondary, 30 primary and 7 special schools.
(mid 1993 - hopefully at least one drive plus 4 discs in every secondary school)	
1992 - 94	Schemes to develop materials specifically related to the National Curriculum
Feb. 1994	£4.5m to put complete systems (2000) into primary schools
Feb. 1995	£5m to put complete systems into primary schools

A list of 46 suggested titles were provided by NCET but LEAs and schools were free to choose their three or four titles from that list. In their evaluation of the scheme, Steadman, Nash and Eraut (1992) found the most popular titles to have been encyclopaedias, newspapers and the World Atlas. Interestingly, the multimedia reading books appear to have been among the least popular titles, even with primary schools. Even at that early stage, the American bias in the discs received widespread critical comment. The evaluators remarked that 'in view of the pressure for higher standards of grammar and spelling, it is hard to justify the direct promotion to schools of CD-ROMs which are American in their language and spelling' (Steadman et al., 1992:15). This was expressed succinctly, and more wittily, on the same page by a year 11 student who remarked 'The only drawback found would be that the computer and I seem to have a difference of opinion on how words are spelt!' (Steadman et al., 1992:15)

The evaluators argued strongly for the British production of CD-ROM discs, especially a choice of British encyclopaedias, which would more closely serve the National Curriculum, as well as CD ROM titles for the Acorn platform; although 11% of schools linked their drives to Acorn systems, they used PC discs under emulation, which caused numerous problems in practice. Many difficulties with the operation of the PC CD-ROMs were reported, resulting in recommendations from the evaluators for standardisation in the loading, installation etc. of CD-ROMs for PCs coupled with the need for a more 'user-friendly' interface. Interestingly, no such problems were reported by Apple Macintosh (MAC) users, who already had a graphical interface. However, these schools expressed concern that the 'friendly' interface resulted in pupils moving icons or changing settings. At this early stage, the helpfulness of standardised icons and navigation of the CD-ROMs was recognised by both staff and pupils. Despite these difficulties, there appeared to be universal enthusiasm for the possibilities offered by this innovation but many schools recognised a need to ensure that users developed skills in searching, selecting and retrieving information as well as the ability to use these skills within the context of the National Curriculum.

Schools located the CD systems in a variety of ways. Just over half of the systems were used in libraries (51%) whilst the IT suite was another popular location (17%).

The evaluators concluded their report by making recommendations summarised as :-

- a choice of British encyclopaedias
- discs with standard front end and more agreement about icons
- easy transition from one disc to another
- inexpensive portable (CD-ROM) disc drives
- a networking project
- future schemes costing in the necessary INSET and support costs
- a revisiting of, and reporting of, the leading edge
- support for schools, LEAs and consortia for producing their own CDs.

Some of these recommendations were resolved by the changes that occurred world-wide to the operating systems plus general improvements in computer technology. Although both MAC and Acorn computers included graphical interfaces and sound as standard, this was not true of PCs. At that time, many PCs were still using the DOS environment where software, including CD-ROMs, could only be loaded by typing in complex coded commands which had little meaning to many users. Users of Graphical User Interfaces (GUI) were able to achieve the same results by moving a pointing device to a picture (icon) and double clicking a button. Paulissen and Frater (1992) considered that a major improvement in ease of operation of PC CD-ROMs occurred when Microsoft included Multimedia Extensions to the Windows 3.0 interface. The initial Standard for Multimedia PCs was produced by Phillips N.V. and published by the Multimedia PC Marketing Council in the Red Book; this included software compatibility with Microsoft Windows Multimedia Extensions but also set a minimum standard of a 286 processor with 10MHz clock speed, which is some 20 times slower than the current standard. These standards were subject to frequent amendments and Multimedia Extensions were included from the outset by Microsoft in the Windows 3.1, and later, interfaces.

The issue of software development had already been addressed by the DfE in a parallel initiative. The CD-ROM Applications Development Scheme had been set up in November 1991 to financially assist CD -ROM developers, over a period of 3 years, in the production of 12 CD-ROM titles for use in British schools. This was linked to a survey of schools and colleges, conducted Nash and Steadman (1993) by behalf of NCET which aimed to collect information on the needs of CD-ROM users to assist educational decision-makers, publishers and software developers with the further development of CD-ROM systems. The report made recommendations both for schools in the use of CD-ROMs and to developers in the design of suitable CDs. Design aspects included the need for :

- ease of installation
- user- friendly interfaces including the facility to change of style, font size, text and background colours to assist access by learners with visual or learning disabilities
- improved speed of response to keystroke press /button clicking
- desire for increased range of British encyclopaedias as newspapers.

The recommended standard tools for searching and manipulation of data were:

- bookmarks (to mark text so you can return to it)
- notepad (to store notes and selections of text)
- thesaurus (to find related search items)
- glossary (definition of term specific to disc)
- dictionary (giving synonyms).

Teachers were recommended to teach their students a range of search skills to enable them to successfully, and efficiently, use various types of CD-ROMs.

Although the formal evaluation of the first CD-ROMs in Schools Scheme was conducted at a time when the evaluators felt that many schools were still at the early stage of familiarisation with the technology, it resulted in the allocation of a further £4m GEST funding for CD-ROM purchase for secondary schools (only) in 1992/3.

The perhaps less well-known DfE funded CD-ROM initiative, CD-ROM for Blind and Partially Sighted Learners: Accessing the Curriculum, was also inaugurated in 1992. This was a joint venture by RNIB and the Open University to establish whether the existing access utilities that enabled computer text to be either enlarged or 'spoken' through synthetic speech could be used to give effective access to visually impaired learners to the range of library materials becoming available on CD-ROM. The results of this initiative were reported by Taylor (1993) and is discussed in greater detail in the section of this chapter dealing with special needs issues.

In all the preceding initiatives, the innovation of CD-ROM technology had mainly been used by secondary pupils. In their evaluation of the first CD-ROM in Schools Scheme, Steadman and Nash remarked that

> very few discs lend themselves to use with young pupils in primary schools or to students with special needs. Language levels are too adult and the procedures for printing or downloading to floppy discs need to be made much simpler if younger pupils are to use CD-ROMs without supervision.
>
> (Steadman and Nash, 1992: 35)

However, by February 1994 the DfE announced an initiative to provided 'complete' CD-ROM systems to primary schools. It considered that

> CD-ROM technology has now sufficient credibility as a stable and reliable set of standard products for schools to give serious consideration to the potential contribution it can make towards better learning.
>
> (NCETa, 1994:1)

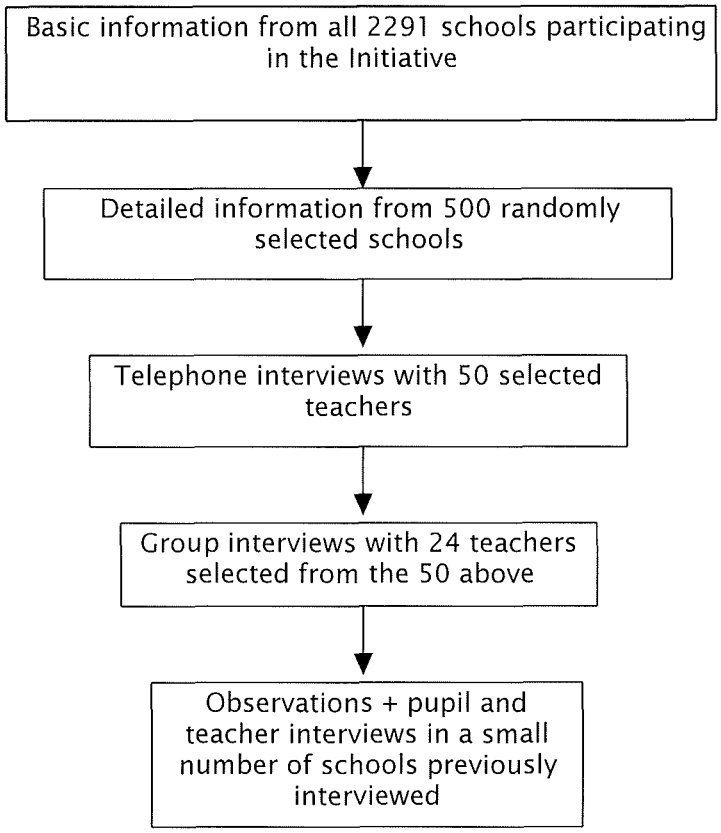
However, primary schools were acknowledged to present additional challenges because they were more numerous and more varied in their characteristics than secondary schools. In addition, the range of ability within any one class was likely to

be greater than at any other phase of education. Since primary teaching is conducted by generalists rather than subjects specialists, equipment tended to be a whole school rather than departmental matter. Finally, that materials suitable for primary schools was only just becoming available.

Unlike the previous schemes, complete multimedia computer systems plus discs were provided; some of those discs were produced under the 1991 CD-ROM Application Development Scheme. As detailed in chapter three, systems were available for PC, MAC and Acorn platforms. The scheme provided funding for a small amount of INSET, nominally two hours for the demonstration of CD-ROM titles, but this was open to interpretation by LEAs, as explained in chapter 3. In order to make choices of the CD-ROM titles to be included with each package, over 200 CD-ROM titles were reviewed by NCET. The results of this process were published as a *CD-ROM Titles Review* (NCET, 1994) which was provided to participating schools to assist them in making further purchases.

As in previous schemes, evaluation was built into the initiative. This was conducted by a team from The Centre for Language and Communications, Open University and reported in *CD-ROMs in Primary Schools - an independent evaluation* (Collins et al., 1996). A summary report was also published by NCET. Information for this evaluation was obtained as shown in fig 2.2. In this way they hoped to obtain both quantitative and qualitative information, within a short space of time, which could be used to represent the experience, concerns and requirements of teachers. In addition, it was hoped to reveal a little of what had been achieved in a short space of time by a diverse sample of schools and to make those findings available to schools contemplating the introduction of the technology.

Fig 2.2 Diagrammatic representation of the information collection methods used by Collins et al (1996)



They reported observations of younger pupils (including those with special needs) using multimedia story books as well as pupils using CD-ROMs for information. These are compared with the researcher's own findings in chapters 6 and 7. In summarising their observations, Collins et al. (1995) considered that CD-ROMs were highly motivating and could be used by children as young as five with minimum support or intervention by a teacher; but that the location of the CD-ROM system was a major factor in determining the amount and nature of this intervention. From their observations, the evaluators were convinced of the value of the use of older pupils to instruct or support beginners. However, they considered that pupils needed appropriate research strategies and clearly defined purposes in order to use encyclopaedia-type software. They reported that CD-ROMs could benefit all pupils, including those with special needs but cautioned schools concerning the tendency for boys to dominate groups in some schools.

Since most schools only had one CD-ROM system, decision-makers (usually the headteacher) needed to make decisions concerning the access to this one system. They identified two strategies:

1. **The Concentration Strategy** - the system was allocated to one, or a small number, of classes and placed either in that one classroom or a shared area easily accessed by all the users.

2. **The Dispersal Strategy** - sharing the system among a large number of classes from the outset and locating it in a common space.

Although they found that schools adopted a wide range of positions on the spectrum between these options, there appeared to be a difference between small and large schools. In the former, they considered that it was much easier for schools to give most classes access to the system. For large schools, this was more difficult to achieve and schools tended to concentrate the use of the one system in a small number of classes. However, they also reported that a small number of these large schools had adopted a policy to spread the use of the system across as many classes as possible. Although some schools, reported on a range of locations of their system, almost half of the schools used the system in a resource or other open area whilst a slightly higher percentage operated the system within classrooms. From their findings, the evaluators produced a suggested policy checklist for schools to assist schools who were considering the introduction of the technology.

They found considerable variety in the way that classroom work with CD-ROMs was organised. This was, in part, dictated by the location of the system and the ease with which staff could monitor children's' work. Many respondents had stressed the need for staff to preview software before purchase and to work through the software themselves before using it with pupils. A substantial majority of teachers considered that research and data-handling skills needed to be taught of pupils were to make

good use of CD-ROM information sources. This view led many teachers to organise activities designed to provide familiarity with such databases and to develop the skills to use them. In designing such activities the evaluators cautioned teachers that...

> It is easy to set 'open-ended' tasks that leave even the most conscientious children marooned and frustrated in a tangle of information.....On the other hand, for children who are content to simply flick from one screen to the next without any particular search strategy, the same disc may offer no more than a stimulating but superficial pattern of novelty and movement.
> (Collins et al, 1995: 17)

The evaluators found that the CD-ROM systems were almost always used by groups of two or more children and they stressed the importance of the development of good co-operative working patterns. They considered that

> schools should look very carefully at what was actually going on when children work together at the CD-ROM system, and what skills may need to be taught in order to operate effectively as mutually supportive members of a 'problem-solving' group.
> (Collins et al., 1995: 17)

The most popular titles reported by the evaluators were encyclopaedias and multimedia story books. The former were predominantly used by older pupils whereas the latter were used across a wide age range; the more tightly focused information sources being much less widely used. These findings are considered in greater detail in chapter 7.

Unlike earlier CD-ROM Initiatives to secondary schools, few schools had reported technical problems with the operation of the systems. However, the 1994 Primary school Initiative provided complete systems that had been already tested by NCET. Where problems occurred, the evaluators considered that they were mainly due to inexperience of the users. Nearly all schools had received some LEA support during the project, much of which was considered at least 'fair'. Teachers commented that access to fast and friendly telephone support was imperative; where provided, a follow-up visit was found most helpful. However, most teachers had familiarised

themselves with the CD-ROM systems in their own time, during school holidays. Recommendations were made by the evaluators for future training needs.

A slightly different, but complementary, evaluation of this Initiative was provided by the Project Officer, Anne Sparrowhawk, that NCET had appointed to this Initiative. The £4.5m allocated to the initiative provided systems and CD-ROMs to 2300 primary schools throughout England. Fifty five of those schools were visited by the Field Officer as part of her evaluation (Sparrowhawk,1995), which also included a postal survey. Although many of her findings are the same as Collins et al (1995), Sparrowhawk provided more detailed information concerning these decisions, perhaps due to the much higher number of observations in schools. e.g. she noted that systems were sometimes operated in an open-access area outside a classroom because schools considered that it offered both the advantages of access by a large number of pupils in addition to remaining within eyeshot of a teacher.

Sparrowhawk identified two foci of use

1. **Content (curriculum) focus** - these schools perceived CD-ROMs as offering a wealth of information to augment the traditional sources. The tasks set for the children were broadly comparable to those used for printed materials. Such schools preferred to use material that was age appropriate and could be related to the National Curriculum.

2. **Skills focus** - these schools saw a need to develop their pupils use of the technology since they considered this would be the general method of presentation in the future. They were less concerned with the content of the CD-ROMs, more of teaching the skills of navigation and extraction of pictures and text to disc or hard copy. Interestingly, although most schools remarked on the high reading age of some of the titles, this was perceived by the 'skills' group as advantageous as they felt that it encouraged the development of 'skimming'. Like

Collins et al. (1995) schools reported using some form of cascade model to teach the skills; this included adult - child as well as child - child (such as year6 - year2).

Sparrowhawk also found that multimedia story books vied with encyclopaedias as the most popular titles. The former were perceived as providing a simple way of familiarising young children with the technology, whilst the encyclopaedias provided information on a wide range of subjects. The issue of differences between navigation of titles was again raised; one of the reasons given by schools for the popularity of the encyclopaedias, despite their high reading age, being that pupils and staff could obtain information on a wide range of subjects whilst only needing to learn to use one title. The least used titles were the more closely focused CD-ROMs that either were not related to the National Curriculum, or were not being worked on at the time (although they might be used later).

Sparrowhawk observed the difficulties experienced by these younger children in searching the information CDs. She found that spelling errors were a common source of failure to complete a search; other problems were attributed to the mis-match between the children's mental classifications and those of the software developer. She considered that preparation work was needed with pupils before they used the CD-ROMs as successful searches were more likely to occur where search words had been identified in advance. Prepared questions also helped to keep children on task. Keeping children on task raised the issue of browsing. Some teachers considered it to be a worthwhile activity, especially for initial familiarisation with a new title, but browsing all the video clips were less valid. Mapp (1993) considered that the ability of CD-ROM users to move rapidly from one topic to another related matter was advantageous as it mimicked the patterns of the mind. However, Sparrowhawk (1994) noticed that some young browsers just clicked around the screen without exploring or examining the results of their actions. Like Collins et al. (1995), she noticed interesting differences between boys and girls views of the technology; boys, she felt,

were inclined to demonstrate the clever things that the CD would do whereas girls talked about qualitative things such as the merits of the sound effects or pictures.

As in previous initiatives, Sparrowhawk reported enthusiasm from pupils and staff for the innovation although many teachers still felt, at the time of the evaluation process, that there were many possibilities for uses of the systems of which they were unaware. Teachers perceived a need for:

- An overview chart to show how the information on the CDs could be used within subjects of the (National) curriculum
- Worksheet resources to facilitate the use of CD-ROM encyclopaedias both at the machine and in the classroom
- Reviews of CD titles published since 1994 to identify material that could be most usefully purchased by schools.

Although a provisional date for responses to these needs was set by NCET for Summer 1995, the researcher has found only a few, isolated responses to these needs.

- The review of CD-ROM titles for the 1995 Initiative was published (NCET, 1995), thus making it potentially available to all schools.
- A British version of Encarta 96 was published by Microsoft, followed later by an education pack for the title, which included worksheet resources and references to uses of the CD-ROM within the National Curriculum.
- The Kingfisher Micropaedia, part-funded by the CD-ROM Applications Scheme, also included a resource pack.

Since 1994, a number of the publications from NCET have included the use of CD-ROM technology. McKeown and Tweddle (1994) discuss the use of CD-ROM titles to provide sources of information as well as the use of multimedia authoring to

communicate information in ways other than text, by emergent writers. Abbott (1995) expanded on this theme, as explained later in this chapter.

Before the evaluations of the 1994 Initiatives were completed, a further CD-ROM in Primary Schools was announced by the DfE in February. However, it was not part of a planned development from the previous initiative but a separate, if similar, use of funds by the DfE at the end of the financial year. This provided £5m, for the provision of 'complete' systems for Acorn, PC or Apple MAC platforms, plus a package of CD-ROM titles chosen by NCET from a possible 500 that were reviewed by teams of people, including the researcher, who were recruited from NCET, Office for Standards in Education (OFSTED), Microcomputers and Primary Education (MAPE) and National Association for Advisors in Computer Education (NAACE). The hardware provided was similar to that of the 1994 Initiative except that a trackerball was provided as an alternative pointing device. This device is commonly used by pupils with poor motor skills or other special needs who find the use of a standard mouse difficult. *Special Edition; Extension to the CD-ROM in Primary Schools Initiative*, (McKeown and Thomas, 1995) provided information, using case studies, on how multimedia computer systems could be used by pupils with a range of special needs. Unusually for a print document, this booklet was intended by the authors to be read in any order! They suggest,

> ..one of the characteristics of multimedia is that it Is not linear. You can choose your own pathway through the materials and wander backwards and forwards as the mood takes you. we'd like you to do the same with this book. Don't read every page. It's not a novel and you won't spoil the surprise if you read the last page first!
>
> (McKeown and Thomas, 1995: introduction)

The two CD-ROM in Primary Schools Initiatives were not part of a long term project by the DfE. Each was unexpected, though welcomed, by schools and were not repeated in subsequent years.

2.2 Software used by schools both to introduce and develop their use of CD-ROM technology

2.2.1 Software used by the CD-ROM in Schools initiatives prior to 1994

The early CD-ROMs were, effectively, just very high capacity floppy discs that were used to store large text based databases, such as NERIS (National Educational Resource Information Source). As explained in the section 2.1, the first publications from NCET concerning the technology looked at four groups of software that were considered to be of particular use within education; encyclopaedias, newspaper archives, dictionaries, large databases. These publications looked not only at the way the titles were used but also at the software itself. Marshall reported that 'CD-ROM adds the valuable capacity to identify EVERY relevant piece of information, not just those you may come across as the pages open' (Marshall, 1991:3). He likened the use of information CDs to using a wordprocessor but cautioned that learners come to a wordprocessor already possessing language and writing skills. However, the equivalent may not be true for information finding. He considered that pupils may not already possess the necessary search skills and considered that these needed to be taught methodically, and over a period of time. He quoted Tucker and Timms (1989) who, in writing about encyclopaedias in general, suggested that the one vital rule in buying an encyclopaedia is that it should be immediately accessible to those for whom it has been purchased. Marshall (1991) included sample workcards to help pupils develop the skills to focus a search that is too wide as well as expand a search that is too narrow. He also stressed the need for more than one CD-ROM to cover any subject area. Unlike printed texts, it was noted that students tended to assume that any one CD-ROM contained ALL the known body of information on a given subject. This need for students to compare information from different (CD-ROM) sources was also felt particularly necessary by other authors in the series. Stewart, Chiang and Coons (1990) cautioned that teachers needed to ensure that this comparison was made on a sound basis as they had observed younger students comparing information by the length of printout! This method of judging the success of a search had also been observed by the researcher in previous observations of primary pupils

using CD-ROM encyclopaedias (McDevitt, 1994). Further, McDevitt reported that such pupils were convinced that the information they wanted was contained within their printout but that they were unable to isolate it from such a large body of, largely incomprehensible, text. Another reason for the need to compare sources, advanced by Stewart et al. (1990), was the preponderance of CD-ROM information sources that were American in origin; they felt that there was to be an urgent need for British material.

At this stage, CD-ROM encyclopaedias were still very similar to their print versions. However, Kenny (1991) pointed out more marked differences when newspaper archives were transferred to CD-ROM. He considered that newspapers had previously been seen as essentially ephemeral. Although they had been stored, making a search of a national newspaper was not a practical task for school pupils. Once the text is transferred to CD-ROM, this task becomes very much simpler. It can also be accomplished without leaving the school premises. However, he notes that newspapers were never meant to be read in the retrospective way that is possible using CD-ROM and uses the term 'undigested history' to describe much of the text. Another difference between the CD-ROM version of a paper and its print version is that articles cannot be seen in the context of the rest of the paper in which they were published. e.g. the advertisements placed on the page, their proximity to other articles etc. is lost in the CD-ROM version. However, unlike the encyclopaedias, there were a range of British newspapers already available in CD-ROM format.

Daly described the rationale behind the CD-ROM Application Development Scheme as:

> This project complements a carefully planned NCET programme of software and hardware support for emerging technologies in education. This Scheme will result in many new titles that explore the nature of the medium and provide quality materials for the National Curriculum.
>
> (NCETb, 1994: 7)

The titles produced under this scheme are shown in table 2.2. Further guidance for developers was produced by the NCET-sponsored survey of schools and colleges made by Nash and Steadman (1993).

The titles developed under the 1991 CD-ROM Development Scheme were anticipated to become available by 1994/5. As can be seen from fig 2.3, most of the titles were aimed at secondary pupils. Of those aimed at younger pupils, only The Kingfisher Micropaedia was chosen for inclusion in either of the CD-ROM in Primary Schools Initiatives (1995). The evaluator's report in *CD-ROM Titles Review* (NCETc, 1995) considers that:-

> The general encyclopaedia has well balanced information which appears to be current and accurate.... It is a highly appropriate reference support for National curriculum subject areas. The text is well structured to suit the target age range...Text and graphics can be enlarged. The interface provides too many options for searches but is generally accessible. Searches are available by keyword, by topic and alphabetical index of articles which can be browsed.....highlighted keywords in the text provide access to other articles.... there is no dictionary facility. The support materials are acceptable and include activity cards which act as tutorials. Overall, the disc is useful and appropriate for KS2.
>
> (NCETc, 1995:351)

Table 2.3. showing the CD-ROM titles developed under the 1991 Scheme

Title	Developers	Platform	Age Group	Notes
The Chemistry Set	The medical School, Univ of Nott'ham ESP, New Media		KS3 & 4	A CD-ROM for Chemistry in the Science National curriculum
Sources in History - Medieval Realms: Britain 1066 to 1500	The British Library	PC ? others later	KS 3	Original source material from the British Library for use in KS3 History Study Unit Medieval Realms
Investigating 20th century Art	Attica Cybernetics	PC	all Key Stages	Developed with Tate Gallery for study and comparison of historic and contemporary art.
SEMERC Special Needs Disc	SEMERC	PC Acorn	KS 1 &2	Pictures and sounds for use by pupils and staff in framework programs or DTP
Technology CD-ROM -The Theatre Disc	TERU , Goldsmiths College	MAC PC later	KS2-4	Uses London theatre world to support project activity in Design and Technology
Investigating Plant Science	Attica Homerton College SAPS	Acorn PC later	KS3, 4 and later	To support Science At 1 and 2: Scientific Investigation, Life and Living processes
Directions 2000	Interactive Learning Prod. Ltd Cleveland LEA	Acorn PC later	KS3 & 4	To provide a model for the teaching of modern languages
Micropaedia - the kingfisher Children's Encyclopaedia CD-ROM	ESM	Acorn PC MAC ?	KS1 & 2	Uses Seelinks software to give easy access to the Kingfisher Children's Encyclopaedia. (CD-ROM version of print book)
Wordroot	John Davitt	MAC PC Acorn	KS 3& 4	Allows users to explore, listen and learn about etymology, accent and the links between words; tied to English NC
Distant Places - AEGIS CD-ROM Interactive Atlas	Advisory Unit	PC	? KS3 & 4	Source of maps, text, pictures datafiles for pupils and staff
The Design Image Bank on CD-ROM	The Design Council	PC	staff + KS3 and 4	Database of pictures for art, design and technology
Comm'nwealth Information Database	Comm'nwlth Institute Ginn		age 8 - 12	Maps, text, photos, animation to provide database on 50 Commonwealth countries. Used in Institute + version for sale to schools
Industrialisat'n in Britain 1750- 1900	Anglia TV	Acorn	KS3	Teaching/learning resource for Unit 3 KS3 History

2.2.2 Software used by the CD-ROMs in Primary Schools initiatives

Schools participating in the 1994 and 1995 CD-ROM in Primary schools Initiatives were provided with CD-ROMs chosen from a large numbers of titles submitted by suppliers and developers. Guidance was provided to both suppliers and evaluators and criteria laid down for the evaluation of titles which were published in the appendix to the *1994 and 1995 CD-ROM Titles Reviews* (NCETa, 1994) and (NCETc, 1995). NCET identified the following broad categories of CD-ROM titles that were considered directly useful to primary schools:

a) encyclopaedias
b) atlases and guides to areas of the world
c) dictionaries and directories
d) full-text literary works (stories, plays, poems)
e) newspapers and journals
f) statistical information
g) bibliographic reference material
h) sources and catalogues of DTP and programming material
i) specialist curriculum support material
j) general curriculum support material.

In 1994, 200 titles were submitted; by 1995 the number had risen to 500. Evaluation was made by teams drawn from NCET, MAPE and NAACE who worked in pairs using common criteria. In writing their evaluations, they used the following summary criteria:

- The adequacy of both content and coverage
- The appropriateness to the National Curriculum in England
- The appropriateness of Reading age to KS1 and 2 pupils
- The quality of the interface design, presentation, degree of interactivity and range of facilities
- The quality of support materials (where submitted)
- The overall quality of the title.

The full criteria for titles were included in the *1994 and 1995 Titles Reviews*. It was suggested that schools might use these to help them with future purchasing of CD-ROM titles and the *1995 CD-ROM Titles Review* has subsequently been included in the list of publications that schools can purchase from NCET. Alternative, less wordy, criteria were devised by McDevitt (1994) to provide a method of identifying possible CD-ROM titles for purchase where time and access to the title was limited. e.g. at an exhibition. However, the checklist method for assessing software based on its attributes is rejected by Squires and McDougall (1994) who prefer criteria based on learning theory, the interaction between pupil, teacher and resource as well as curriculum issues.

Although a few titles were developed for the National Curriculum at Key Stages 1 and 2 under the 1991 Scheme, the vast majority of CD-ROM titles both provided by the DfE Initiatives as well as used in the case study schools, were not. The majority of titles submitted to NCET for the Initiatives were commercially available products that the suppliers considered fitted the criteria laid down by NCET. In many cases, they were not originally devised for use in education and many were American in origin. This contrasts strikingly with the introduction of CD-ROM technology to the Australian education system, which is familiar to the researcher, where there was a national five year plan for the introduction of CD-ROM technology (Department of Communications and Arts, 1993). This included the funding for the development of CD-ROMs to meet the needs of their curriculum as well as the training of teachers in the use of the technology.

2.2.3 Alternative sources of information for schools concerning CD-ROM titles

Sparrowhawk (1995) reported that schools were seeking independent information to assist them in making purchases of suitable CD-ROM titles. In response to the rapidly increasing range of CD-ROM titles arriving on the British market, a number of publications appeared that were dedicated to CD-ROM technology. Titles such as *CD-ROM Today (* Elko,1993), *CD-ROM World* (Harris, 1993) first appeared in America in

1993, arriving in Britain in Spring 1994. Although primarily aimed at the rapidly increasing home CD-ROM market, they contained pages, or sections, devoted to CD-ROM titles suitable for children and/or schools, although the criteria used to evaluate titles is not given. Some biographical information on the reviewers is provided in *CD-ROM Today* (Noonan, 1994) but none appears, from the information given, to have a background in education. The word 'edutainment', appears in first edition. In an article 'entitled 'That's Edutainment', Matthews (1994a) uses it to describe titles that combine education with entertainment. His review of Arthur's Teacher Trouble (Matthews,1994b) contains:- 'It includes a printed copy of Marc Brown's colourful book, but children won't even give it a second look - unless there's a power cut.'

By mid 1995, there was also a version of *CD-ROM Today* dedicated to children's titles. Although the first two editions of this magazine were entitled *CD-ROM Today - Kids* (Richards, 1995), by August 1995, the title had changed to just *PC Kids* (Mallinson, 1995). By 1997, magazines dedicated to CD-ROM technology would seem to have disappeared from the newsagents shelves. Similarly, books with titles such as *Multimedia Mania* (Paulissen and Frater, 1992), *Que's CD-ROM Buyer's Guide* (Busch, 1994) arrived on the market, to assist users with the purchase of hardware and/or software. Like the magazines, these were primarily aimed at the home market, were potentially available to schools, but tended to concentrate on the technological, rather than educational, aspects of the titles reviewed.

In 1994, a number of the traditional 'educational' publications began to include articles, supplements and reviews of multimedia and CD-ROM software. NCET inaugurated the magazine *Envision* (NCETa, 1993), whose first edition in Summer 1993 was dedicated to multimedia. A pattern emerged amongst these publications: from a trickle of articles in 1993/4 there appears to be a peak of special editions concerning multimedia and CD-ROMs in 1994. e.g. *Microscope* (1994), *Times Educational Supplement* (1994), gradually disappearing as a separate entity by 1995/6. Drage (1996) includes the use of dictionaries on CD-ROM with hand-held

spellcheckers/ thesauruses as part of a general article on the use of IT as a tool to assist writing.

Heppell (1994) predicted that the term 'multimedia ' would be a transitory term since he considered that soon all computers would be capable of delivering multimedia. What, he felt, to be of greater importance was to discuss the extra contributions that these additional media might add. In examining the issues, he opined that multimedia designers had been too concerned with what was technically possible rather than what was pedagogically desirable, and in what context. He wished to see a time when users could participate creatively, and with delight, in these new learning environments. However, he feared that current software addressed the needs and intentions of the designers, rather than the intended users.

2.2.4 Considerations for the design of CD-ROMs

In considering principles for the design of multimedia software, Mann (1995) argued that a shortcoming in the design occurred when a user's attention was divided between mixed media messages and quoted an example of a stochastic sound cue which caused attention to be switched back and forth between conflicting unintended messages. He considered that where a message was given using two or more communication channels, that audio would take the redundant role. He argues for the use of structured sound function (SSF); to use sound to enhance visual messages, reduce visual clutter, and help users to shift their attention from visual and auditory sensations.

In her advice for CD-ROM developers, Sparrowhawk (1996) suggested the following 'rules' that she considered to be appropriate to both the home and school markets:

1. Allow the user to be in control, both - of where they go and how they get back again and of which resources (such as speech/video) are presented to them.

2. Keep the information structure as flat as possible so that it is possible to get lots of the information without having to pass through many screens on the way.

3. Make the search mechanisms as simple as possible, providing a good quality index, and where appropriate, classification structures which match a child's vocabulary, or which positively develop their vocabulary.

Of these, she considered the overriding consideration should be to try to keep the interface as simple as possible and at all times to avoid the introduction of unnecessary, if exciting, features which she described as 'feature creep'.

2.3 Curriculum considerations; changes that the use of the technology made to the delivery of the National Curriculum.

Before examining how pupils used the innovation of multimedia technology, it may be helpful to look at how the innovation was disseminated to their teachers. Government funded IT initiatives have followed the cascade model established during the Micros in Schools Schemes of the 1980s. Teachers were given a short intensive training period to introduce them to the operation of the hardware and chosen software. They were then expected to return to their schools and pass on this information (cascade it) to the rest of the staff who would, in turn, 'cascade' the information to their pupils. Although it has been repeatedly used, this model has not been without criticism. An essential feature of the cascade model is that it relies on those who are 'trained' becoming 'trainers' of the next stage of the cascade. In examining the success of government IT initiatives, Boyd-Barrett, commenting on the cascade model, noted that 'for one reason or another, if they (the teachers) gained any expertise, it looks like they kept it to themselves!' (Boyd-Barrett,1990 ; 170). Russell (1988) considered that part of the reason for this lack of success of this model was because the training focused on the use of software, often in isolation from the curriculum. He proposed that the best method of IT INSET was for teachers to appreciate a curriculum application of the computer before becoming familiar with

it. However, in re-examining the implementation of IT innovations in 1995, Russell (1995) found that very little had changed. Maddux (1993) took this idea further and proposed three stages in the use of IT in education where technology-led uses of IT, as found in these initiatives, was just the first. At this initial stage, Maddux said that children were expected to become computer literate simply by being exposed to the computer and this (exposure to computers) was expected to produce educational benefits. He considered that research had verified that for most children 'nothing miraculous happens automatically as the result of putting a child and a computer in the same room.' (Maddux, 1993: 14). As noted in the previous section, the CD-ROM in Primary Schools Initiative included funding for a short (2 hour) INSET period to introduce the selected CD-ROM titles (software). This could be considered to have moved on to Maddux' Stage Two of IT use where exposure to particular applications was expected to produce educational benefits. He considered this to be an improvement over stage one but that emphasis is still placed too heavily on exposure and little attention given to learner variables or to teacher variables. He stated the hypothesis on which this model is based as:-

> **If learners** (at any level, any age, any gender, any grade, any IQ etc.) **are taught** (some computer application) (for any length of time, using any method, by any teacher, etc.) **they will improve more in** (some cognitive or performance variable) **than an experimental group who are taught traditionally** (whatever that is).
>
> (Maddux, 1993:16) (bold in original)

Only when the uses of IT, and research questions concerning such uses, concentrate on the learner/treatment interaction, does Maddux consider that Stage Three is achieved.

Maddux' Stage Two hypothesis appears central to the 1994 and 1995 CD-ROM in Primary Schools Initiatives. Although this research project does not attempt to examine the learning that is taking place, it seeks to report on, and propose reasons for, observations of this hypothesis in action.

Following on from this hypothesis, Brown and Howlett (1994) advised teachers to ensure that computers are used in worthwhile activities and that tasks should:

- have clear learning outcomes
- be described simply and directly
- offer opportunities for different styles of learning
- relate to cultural backgrounds of all students
- be interesting to both boys and girls.

Similarly, Perzylo (1993) stated that 'for effective learning and research to be conducted .... the learners should be involved in purposeful learning: most importantly, they must be given appropriate instruction with regards to searching and ample time to navigate through such resources' (Perzylo, 1993: 194). This point was amplified by Taylor (1996) who considered that we could not expect children to make good educational use of these new technologies - just because they are there. Although empowering learners involved giving them responsibility for their own learning, she suggested that children needed to be taught skills, at an appropriate level, to handle multimedia systems. This would not only enable them to make full use of the potentially vast resources of information at their finger tips but also allow them to make judgements about relative values of different kinds of commercial applications.

The researcher noticed that a number of writers reflect on the problems of information overload and include this quotation

> The greatest challenge facing us now is how to transform information into structured knowledge, and not allow people to deny us choice by inundating us with information ... information has to be transformed, to be given a structure, in order that we are able to control it and understand it.
>
> Vartan Gregorian
> (quoted in 'A Walk up Fifth Avenue' by Bernard Levin)

Taylor (1996) suggest that where children are using CD-ROM information sources within the classroom situation, that control shifts from teacher to learner - but in a

way that the teacher determines. She considered that by carefully designing worksheets and setting up tasks, the teacher could engineer situations in which children feel that the decision making is in their hands and that they are in control, but which the teacher is directing. She expanded on this theme of worksheet design and cautioned against multiple choice worksheets that demand little more than a ticked box which she felt do not draw the best from any research activity. She stated that

> Whatever the overall purpose of the worksheet, teachers need to ensure that they provide a suitable context and clear aims for student to work to and that they engage children with the material on the disc. A well-designed worksheet can also provide an effective transition between off-line and on-line work.
> (Taylor, 1996:17)

Reporting on the use made of CD-ROM titles in the Multimedia Special edition of Microscope, Wald (1994) noted that for most children, some period of unstructured 'play' with the CD-ROM titles appeared helpful; but found that the length of this period varied considerable within individuals. He used a printer with the system as he considered it important to children that they took something back to their desk as a record of their achievement. He was cognisant of the need to teach the children search skills and used a simple sorting game on a BBC computer to assist this. However, he did not feel this lack of search skills to be specific to the use of CD-ROM. He had observed children randomly browsing the library books or looking at the cover pictures in order to select suitable titles. He recommended that children should be given time to play with a title first then be taught how to quiz the particular database. Ideally, he felt that there needed to be a teacher present who could interact with the pupils. In practice, he felt that this would probably be 'adult help'. He considered that the use of CD-ROM technology offered a powerful and flexible classroom resource but was concerned that it should not become 'another IT solution looking for a problem to add to the teach and test attainment targets.'(Wald, 1994: 29)

Other teachers in the same publication, such as Hinton, (1994), Aiken,(1994), Roberts,(1994) were unanimously positive about the innovation. They noticed the American bias of the material but did not feel that children were worried by, or even noticed, the bias. They also recognised the need to teach search skills but noted that children found ways of compensating for their inadequacies. Coupland (1994) observed that pupils who lacked the skill to cut and paste text either printed everything or copied out the relevant information by hand. However, he suggest that one of the conundrums of information handling is that:

> You have to know what you are looking for before you can find it
> or
> whatever you find is, by definition, what you were looking for.
> (Coupland, 1994: 32) (format in original)

What teachers did not seem to have expected was the effect that typing or spelling errors would have on the success, or otherwise, of a search. Children's impression of the infallibility of the CD-ROM was noted by several contributors. However, Treadway (1994) reported that pupils in one school who had been observed debating which of three possible CD-ROMs to use, had decided to use all three and compare results. He suggested that this different attitude was, at least in part, due to the school's policy to teach information skills as a result of their previous year's use of CD-ROMs.

The need to equip children with information finding skills was voiced well before the advent of CD-ROM technology. Although referring to the use of traditional information source, Wray (1985) wrote

> as teachers, we have given generally far too much emphasis in the past to what children learn, rather than how they learn it.... What seems more important is that we teach them how to go about gaining the information that they, themselves, see the need for. The ability to find and handle information becomes more and more crucial, the more information there is to handle.
> (Wray, 1985:84)

In examining recent uses of IT in schools, Crook (1994) found that evaluation of what is learned from an innovation was not easy. He felt that its use had rarely been planned in pragmatic terms and the pressure for innovation had largely been applied

from above; practitioners themselves feeling little sense of dealing in options for change. Instead, there had been an atmosphere of seizing opportunities that were offered and then improvising a way forward. He considered that although pupils had more opportunity to access computers, it was unclear whether this has helped them to learn.

Watson (1993) also considered the effect of the use of IT on children's learning in the ImpacT Report and concluded that IT made a contribution to learning but the contribution was not consistent over subjects or age groups. In searching for the reasons for these inconsistencies, these researchers described the positive effects of using IT, such as increased motivation and concentration, but also identified factors which worked against effective use of IT such as:

1. Teachers having insufficient knowledge of software and understanding of the principles behind its use
2. Pupils being unable to co-operate effectively
3. Pupils having difficulties in learning to use the software
4. The existence of a minimum threshold to make the use of IT effective.

Having observed that the positioning of a system can be an important factor in is successful use, Crook (1994) proposed new ways of grouping machines so interaction and collaboration between pupils can occur. Peterson (1995) reported on a school in America where this form of grouping of pupils and computers occurs in a highly IT-rich environment. The use of multimedia is central to the way that learning has been changed in the school. However, multimedia is not only used as a source of information but also as the basic method of recording by pupils. A single multimedia authoring program is used throughout the school as their main reporting mechanism. Monteith et al (1993) expand on this theme of non-linear writing. Although used in schools where the level of computer provision is rather closer to the norm in Britain, several contributors enlarge on this theme of alternative ways of creating narrative. In considering the use of Hypermedia in the teaching of English,

Marcus (1994) discusses the work Gadda (1991) on the narrative styles of various cultures. Drawing on the work of Kaplan (1966) to describe the predictable differences between paragraphs written in English by students with various first languages he proposed graphical representations which he considered would superficially describe the movement of the various paragraphs as shown in Fig 2.4.

Fig 2.4 Diagrammatic representation of the development of paragraphs written in English by students with various first languages.

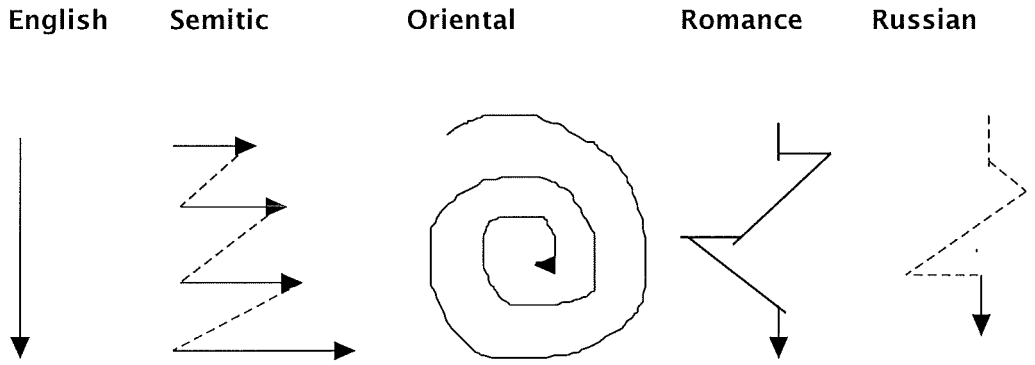


Fig 2.4

(as shown in Computers and Language, ed.Monteith,1993:40)

He proposes that the paragraphs written by Arabic students are based on a complex series of parallel constructions, both positive and negative; Asian writing is marked by what may be called an approach by indirection, (showing) the subject from a variety of tangential views but..never looked at directly' English 'first language writers' in 1966 are represented as a direct line. Marcus suggests that this work implies that there are alternative paths through any body of knowledge. Heppell (1994) takes this idea a step further. He reasons the changes in both children and their everyday lives should be reflected in the way information is both provided and reported. teachers, he feels belong to the 'radio age' where information as delivered in a narrative style. However, he suggests that we have all changed out media habits and capabilities since that time and children, in particular, tend to 'graze' information from variety of sources. Coupland (1994) made a distinction between traditional sources of information and CD-ROMs and suggested that 'a book has a front, a middle and an end - a CD-ROM goes round and round' (Coupland, 1994:32). This

alternative information gathering mechanism is considered by Heppell (1994) to be used by media organisations such as TV companies where programmes are designed with little narrative structure but complex information dimensions - text, video - edited with great rapidity, separate background projection, music and graphics. He suggests that children need a browsing, grazing environment where learning autonomy is fundamental; where metaphor and interface design are of primary importance and where sound bites, video snatches, auditory icons and text labels offer a complex participatory environment that challenges learners and recognises their increasing sophistication as information handlers an creators. He considers that the implications for both multimedia and learning are both complex and significant and opines that many publishers, in seeking to provide electronic books and narrative on CD-ROM, are a generation too late. However, he considers that both the requirements of learners and their teachers can be met. By identifying the progressing emergent capabilities of learners might lead teachers to look through fresh eyes for new learning outcomes but cautions that real change is unlikely to occur by trying to deliver old learning outcomes using new technology.

In order to use new technology to deliver new learning outcomes, it may be necessary to rethink the design of schools. Marcus (1997) reported on a new design of school, recently opened in America, that appears to make such changes more possible. The innovative approach to both the building and its curriculum delivery is hoped by the instigators, an international firm of financial consultants, to move education from the industrial age into the information age. The school has no internal walls, class periods or textbooks. Instead computer workstations are clustered into pods to encourage team work and performance is assessed via reports that learners are required to present, as well as standardised tests; teachers are known as 'facilitators' and pupils are 'learners'. A similar initiative was reported by Petersen (1995) concerning another school in America opened in 1991 with a mandate to rethink education. The result is not only a technology-rich environment but one where pupils tasks and responses reflect the mixture of media available to them. This is achieved

by the simple change to the use of a multimedia authoring program rather than a wordprocessor or exercise book. Although both schools have adopted a very innovative approach to education, high achievement by pupils is reported by both schools and may point the way to an alternative way of achieving excellence in schools without a return to very traditional, formal teaching methods.

2.4 Implications of the preceding three items for pupils with special needs, especially those with hearing impairment.

As can be seen from diagram 2.1 one of the earliest government funded multimedia projects was the Interactive Video in Schools project which included funding for an investigation into the use of interactive video in the education of the deaf (Jones, CFG ,1986). The researcher's interest in Multimedia was aroused though attendance at a lecture given by Dr Jones, then project development officer for the deaf at the Scottish Interactive Technology Centre. However, before looking in greater detail at this project, it may be helpful to consider the reasons why teachers of the deaf were so interested in multimedia. Pester suggests that

> any significant degree of hearing loss can have a devastating effect on the ability to use language (linguistic development) and the ability to think and learn (cognitive development). As a result, educational achievement and personal development may be restricted.
>
> (Pester, 1993: 4)

She continues by offering some of the commonly used descriptors of hearing impaired children, such as 'egocentric', 'concrete', 'impulsive' but considers that these are potential rather than inevitable effects of hearing loss.

In considering the value of collaborative experiences of learning, Crook (1994) discusses Vygotsky's proposal that all cognitive functions are first experienced in the inter-mental plane before they exist on the intra-mental plane.

> *An interpersonal process is transformed into an intrapersonal one.* Every function in the child's cultural development appears twice; first, on the social level, and later, on he individual level; first between people (*interpsychological*) and then inside the

> child (*intrapsychological*)... All the higher functions originate as actual relationships between human individuals
> (Vygotsky, 1978 :57) italics in original

He interprets this as meaning that our private mental reflections arise from experiences that have first been organised in the public forum as social interaction.

Hall proposed that

> a child's development of language occurs through the attempt to engage in communicative acts - both as a producer and a receiver. and that... most studies of young child-adult interaction show that it is usually the child who initiates and terminates the action, rather than the parent.
> (Hall, 1987: 13)

He cites the claim made by Wells that

> adults are intuitively aware that the major responsibility for actually mastering the resource of their language rests with the child rather than with themselves and that their role is essentially one of sustaining and encouraging the child's self-activated learning.
> (Wells, 1987: 71)

Webster (1988) suggested that what children learn in their active discovery of language in meaningful social encounters, is then applied to making sense of print. He considered that teachers may need to look beyond the fact that deaf children may be unable to hear sounds in words, have visual-perceptual problems or less well-developed vocabularies, syntax and semantic awareness. He argued that

> if children are not expected to enquire, initiate questions, seek out rules and reconstruct their own models of how language works, they will be poorly prepared for actively reading for meaning. Teaching must then address additional problems for deaf children, moving then towards independence in learning, aware of how to go about their own study, learning how to learn.
> (Webster, 1988:81)

Whilst agreeing with Piaget's view that children actively construct their knowledge of the world, Wood (1988) believes that adults, social interaction and communication play far more formative role in the development of children's thinking and learning than his theory allows. He considers that the child's intercourse with the physical world provides the main constraints on, and contributions to, intelligence. Children's knowledge, he suggests, is often a product of the 'joint construction' of understanding by the child and more expert members of his culture. Wood suggests

that one of Vygotsky's main contributions to educational theory is the concept termed the 'zone of proximal development' which Vygotsky used to refer to the gap that exists for an individual between what he is able to do alone and what he can achieve with help from one more knowledgeable or skilled than himself.

For children with hearing impairment Webster (1989) stresses the importance for teachers of seizing all the opportunities presented in school, across the subject boundaries, where children are involved in talking (or signing). He considers that

> the most effective learning experiences are those which impel the child to use language in situations which are meaningful to themselves and their lives..'....
> Good teachers begin with a clear understanding on children's existing understanding....the greatest impact is often achieved through real-life visits or participatory experiences.....more remote subject matter... can be brought to life with photographs, artefacts, tools or implements, archive material, recordings, video, role play, stories poems and printed evidence such a s news reports.
>
> (Webster, 1989: 83-84)

At the time of his writing, computers were only just being introduced into schools but he was enthusiastic of the benefits that they offered to deaf pupils..

> material is presented visually; children find (micro) computers non threatening, non-judgmental, stimulating and highly motivating; learning steps can be individually paced and controlled by the child; children can take risks and make mistakes; there is opportunity for repetition and overlearning for children who have difficulty in retaining ideas and forming concepts, linked with immediate feedback...
>
> (Webster, 1989: 90)

He was particularly impressed with the possibilities of multimedia, then only possible using interactive video which he considered to be

> an area of development with incredible potential for education. essentially software acts as a database where pictures, maps, statistics, programs and simulations are stored. The materials are then used to foster co-operative learning, problem solving, research skills, decision making and creative thinking skills.
>
> (Webster, 1989: 91)

The interactive video (IV) to which he was referring was developed by Chris Jones, himself prelingually deaf, when working at the Donaldson's School for the Deaf in Edinburgh. Jones (1986) considered that deaf children miss out many opportunities of the imperative dynamic link between language and action. Using IV he hoped to enable deaf children to learn by relating language with visual images. His first three IV discs concerned aspects of language development which Jones (1990) considered caused difficulties for deaf pupils but for which IV appeared to offer new and participatory learning environments. These environments were based around the type of microworlds described by Papert (1970) but used well-known television and book characters. The IV dictionary included multimedia versions of the Link Up reading books. However, unlike later multimedia books, these were designed specifically for deaf pupils so when the child clicked on a word they did not understand, they could see both a picture of the word and/or video of a person both signing and saying the word. Unfortunately, these were produced on 12" video discs that required both very powerful and expensive computers as well as the appropriate video disc player. Since this used a different system from the Doomsday project, few schools were able to benefit from this innovation.

At the 1992 NCET Conference On Special Needs and IT, Forth, the Minister for State for Education, challenged the Special Needs Community to identify ways of overcoming barriers to learning faced by students with learning difficulties or disabilities. One such barrier that was identified was the difficulty experienced by the visually impaired in gaining access to information. The DfE funded a project to address this matter which involved both the Royal National Institute for the Blind (RNIB) and the Open University (OU) and was managed by NCET. Few information books are published in Braille or large print; even where available, they are both time consuming and cumbersome to use. At the time, some encyclopaedias were being published in CD-ROM format. Unlike later editions, these early CD-ROM encyclopaedias were exclusively, or predominately, DOS text. This enabled the project to use standard text search methods in conjunction with established DOS text access

utilities. Information on screen could be accessed either in large print or synthesised speech and printouts obtained in text or Braille. In *Opening up the library for visually impaired learners*, (Taylor, 1993) both pupils and students were enthusiastic about the possibilities of the technology both for personal research both by individual pupils and as a means of preparing class materials. Although access to a greater range of information sources was appreciated, the recurring theme in this document was the way in which the search facilities facilitated better use of student and staff time. Unlike traditional sources, information could be obtained rapidly and time used to concentrate on the information itself. Students also appreciated the opportunity to listen to the text, rather than struggle to read in either print or Braille. Case studies reported on blind pupils who were finding articles, listening to them and making notes on their own portables in a similar way to a sighted pupil reading a textbook and making notes on paper. The project reported high success using one particular form of CD-ROM technology, namely DOS text. The most popular CD-ROM title was a 'DOS text only' version of Information Finder. Much greater difficulties were found when students tried using a newer, more graphical CD-ROM, operating in the Windows environment. This was included in the project because it had been specifically designed for the education market and was already owned by several of the participating schools. Although Mammals was reported as 'popular with partially sighted children', it could not be accessed using the project utilities nor text obtained easily in suitable form for use by this group of learners. Ironically, this was the only one of the CD-ROM titles used in this project that was subsequently used in the CD-ROM in Primary Schools Initiative. Although Information Finder appears common to both, a later, Windows version was used for the Primary Initiative.

Access utilities for the visually impaired to graphical interfaces still remains a problem. Access Technology 1994/5 cautioned readers concerning the use of CD-ROM technology that

> These discs are potentially of great benefit to learners....However, problems with the choice of operating system are emerging; more and more publishers are moving to

> graphical user interfaces. Speech synthesisers find it difficult to function in these environments
>
> (RNIB, 1994: 21)

Later in the document, the only speech access screen reader operating in the Windows environment is reported as 'under development'!

Despite these practical difficulties, it was recognised that CD-ROM technology had a potential to reduce the barriers to learning by pupils with a range of special needs and its use was included in a number of more general educational IT publications. McKeown and Tweddle (1994) discuss ways of using multimedia with emergent writers both as sources of information as well as authoring to communicate information. In writing of the way in which it can be used to support the development of literacy skills, Abbott considers that

> ..the combination of text with sound and pictures can make ideas more accessible. Each element of the multimedia can reinforce the meaning and its multi-sensory nature can help many learners to understand ideas and information that might be too difficult through text alone.
>
> (Abbott, 1995: 8)

He suggests that pupils who do not have the necessary searching skills to use traditional encyclopaedias can do so with CD-ROM titles because there are usually alternative paths ways to reach the required information. He postulates that accessing information from a CD-ROM requires different skills from traditional information handling. The publication includes a case study of deaf children who were able to 'read' a commercial talking story, once animated signs were added. However, in the absence of details concerning the way in which this amendment to the original product was made, it is difficult to judge whether this would be a practical proposition for schools.

The use of CD-ROM story books as a strategy to develop positive attitudes to reading by otherwise reluctant readers was examined by Adams and Wild (1995). They reported that not only did these pupils demonstrated a strong positive attitude

towards reading CD-ROM story books but that the positive attitude they developed towards reading was also transferred to their reading of traditional materials.

The need for schools to provide access to CD-ROMs to pupils with special needs was recognised in the 1995 Extension to CD-ROM Initiative. The hardware provided to schools included a trackerball, in addition to the standard mouse. Schools were also provided with one of the most interesting publications concerning the use of CD-ROMs. Like many CD-ROMs, McKeown and Thomas (1995) designed their publication to be read in any order! Each page contains a 'snapshot' of a of typical pupil with special needs in mainstream and special schools showing ways in which the use of CD-ROM technology had proved beneficial. They suggest that teachers should not attempt to read every page but choose those referring to pupils in their class who might need help and follow the instructions. The similarity with browsing a CD-ROM is further enhanced by the authors' suggestions that readers should flick through the book, look at the pictures etc. One of the 'snapshots' concerns a profoundly deaf pupil using a CD-ROM dictionary in a broadly similar manner to the pupils in the Hearing Impaired Unit of school C. The use of sound with a partially hearing pupil is also explored.

Orford (1995) also discussed the use of sound on CD-ROMs with hearing impaired pupils. He identified titles where there was an option to remove effects and music whilst retaining 'speech' as particularly helpful. For pupils with poor speech discrimination, he considered that on-screen text could support an imperfectly perceived spoken sentence. However, to do this, the text needed to be a verbatim version and presented in synchrony with the speech. He noted that some packages offer a précis of the spoken words or expanded caption of the visual image being presented; neither of which he considered to offer real support for the understanding of speech. Americanisms too, were considered to cause additional difficulties due to the changed grammar as well as voice.

He also noted that the text presented on screen could present reading difficulties for language delayed pupils. Although some CD-ROM titles presented text in a larger font he felt that few offered alternative levels of language. Despite these difficulties, he was convinced that many hearing impaired children depended a great deal on the visual channel for their comprehension of the world around them and that the visual elements of a multimedia package could enable understanding in unique and powerful ways.

The recognition by NCET that if pupils with a range of special needs were to realise the potential benefits of CD-ROM technology, then their difficulties in accessing the technology required to be identified, resulted in the publication of the document CD-ROM - a matter of access (NCETb, 1993). This document aimed to raise the awareness of software publishers and developers, to explain the difficulties and suggest ways of overcoming them at the design and production stages of a CD-ROM. In these ways, it was hoped to optimise the enabling process. Although concentrating on the needs of physically and visually impaired learners, many of the suggestions could be applied to a wider range of learners, such as:-

- clear, and readily distinguishable, icons
- spoken captions to pictures
- font sizes, colours and styles configurable
- text read-out whenever possible
- consistency in screen layout.

Indeed, Howarth (1997) argues for many of these same attributes in the design of a CD-ROM interface for primary pupils.

Although not confined to the use of CD-ROM technology, the recent Review of Software for Special Educational Needs (DfEE, 1997), re-examined the use of software by pupils with special needs. This was divided into two broad categories: *software to enable access* and *software to support learning*. For each category, key issues were

identified and recommendations made. However, in considering the issues, the interrelation between software, hardware and peripherals was recognised and the report covered more than just software. The researcher considers that one of the most important suggestions is that developers should be encouraged to produce software that is 'access aware'. It is further proposed that consideration be given to the setting up of a task force to develop software standards for access utilities along with the 'kite-marking' of products that provide a full range of accessibility tools. The involvement of small software developers in this field is recognised along with their need for low cost access to the required development hardware as well as on-going information concerning the implications of changes in technology to software development. Although reference to these ideas is made in the White Paper published by the DfEE (1997), practical results of these proposals are unclear, as yet. However, they appear to point the way towards a better realisation of the potential of CD-ROM technology for learners with special needs than has been previously possible.

Summary

In this chapter, background literature to the research has been examined, concentrating on four main areas. These findings have been summarised using these same headings.

1. The Initiatives that led to the introduction of CD-ROM technology into primary schools

For a period of ten years there were a number of government initiatives to foster the use of multimedia technology into schools. These initiatives were all technology, rather than curriculum-led. Early initiatives were aimed at older secondary pupils; the age range of pupils who might benefit from these initiatives was gradually lowered, culminating in the introduction of CD-ROM technology to primary schools, when the commercially available software was deemed accessible to that age group. However, these initiatives should not be viewed as a planned progression, more a series of unconnected events. Over the ten years, the evaluation of these initiatives became more rigorous. The main issues raised by successive evaluators are surprisingly similar, yet most remained unanswered by succeeding initiatives. Despite criticism by

both participants and research findings, the cascade method was consistently used to disseminate the innovation to teachers.

2. Software used by schools both to introduce and develop their use of CD-ROM technology

Over the last ten years, there has been a vast increase in the availability and ease of use of CD-ROM software. Almost all of the CD-ROM software used by schools both independently and through government initiative was standard commercial software, predominately aimed at a world, non-education market. Unfortunately, there is no standardisation of screen layout, icons or search methods. The need to learn the navigation of each individual CD-ROM title encouraged beginners to use a restricted number of titles. Large encyclopaedias have always proved most popular with schools; multimedia story books vie for popularity in primary schools due to their ease of use. Much of the material used by the government initiatives was American in origin. Although the need for British material was reported by a number of evaluators, only one government initiative was aimed at the production of a small number of CD-ROM titles for the British National Curriculum. In response to the evaluators' reported request from schools, NCET published information to assist them in the selection of suitable CD-ROM titles. This has been taken further very recently in the proposal to kite mark (commercial) software that is considered by the DfEE to be of outstanding quality.

3. Curriculum considerations; changes that the use of the technology made to the delivery of the National Curriculum

In order to access the vast amount of information that can be contained within a CD-ROM, pupils require to posses a range of search strategies. The need to teach age-appropriate search skills was recognised very early by teachers and evaluators. A number of publications included advice on the writing of suitable worksheets and task to develop these skills. However, these are broadly similar to those used for traditional sources of information.

Information is both stored and accessed quite differently on a CD-ROM and a book. Unlike books, a CD-ROM is essentially a non-linear source of information. Researchers have suggested the corresponding use of non-linear writing as a more appropriate recording method. This offers the opportunity both for changes to the delivery of the curriculum and responses expected from pupils. However, with few exceptions as yet, CD-ROM information sources have been used by schools in a broadly similar manner to traditional information sources requiring traditional response methods.

Although almost all teachers and pupils expressed enthusiasm in the innovation, there is little evidence of real change to the curriculum brought about by its use. This effect my be explained by the use of Maddux (1993) stages of use of IT in education. Both the government initiatives and schools response to those initiatives operate at stage two where exposure to certain applications is expected to provide educational benefit. Only those schools that have moved to stage three where there is concentration on the learner/treatment interactions can the potential of the technology be realised.

4. Implications of the preceding three items for pupils with special needs, especially those with hearing impairment

The use of CD-ROM technology to provide multisensory access to information has been recognised by a number of writers as of particular importance to pupils with a range of special needs. However, this potential cannot be realised if pupils cannot access the technology. Two early government initiatives aimed to explore the potential of multimedia technology for pupils with special needs; however, the technology used by these initiatives is now inappropriate for current interfaces and software. Further attempts have been made to raise awareness of schools and commercial software developers to their needs by both publications and hardware supplied by the last government initiative. This has recently culminated in the proposal that commercial software used by schools should be 'access aware' and the 'kitemarking' of software of excellence.

Research suggests that hearing loss can have a devastating effect on the child's ability to develop language and consequently on their ability to think and learn. CD-ROM technology can be used to engage the child in language development experiences that are meaningful to themselves, using a range of sensory channels. However, one of the greatest difficulties encountered by hearing impaired pupils in accessing CD-ROM technology is the discrepancy between the language under their control and that of the software they are using. Unfortunately the government funded initiative to develop interactive video to address this issue was not continued or adapted in the light of technological change. Instead, the reported use is now of standard, commercial software where the multi-channel aspect of the technology is proving advantageous, especially when less helpful, or distracting channels of information can be removed.

Having looked at the background literature to the research, the dissertation moves on, in the next chapter, to explore the methodologies that were chosen to answer the research questions and explains the reasons for those choices.

Chapter 3

Methodology

Introduction

> Research is best conceived as the process of arriving at dependable solutions to problems through the planned and systematic collection, analysis and interpretation of data. It is a most important tool for advancing knowledge, for promoting progress and for enabling man to relate more effectively to his environment, to accomplish his purposes, and to resolve his conflicts.
> (Mouly (1978) within Cohen and Manion, 1994:42)

However, on a more practical note, Edwards and Talbot (1994) remind prospective researchers that

> of equal importance to selecting the right research question and deciding of the design of the study, is selecting the method of enquiry you will use (Edwards and Talbot,1994:70)

and urge consideration of methods of enquiry that will address the issues of validity, reliability and feasibility of the study. Having developed the range of research questions and subsidiary questions detailed in chapter 1, the researcher needed to consider the methods of enquiry to be adopted. Her own educational background is within the physical sciences where studies are undertaken, with strictly limited variables, providing quantitative data that can be validated by repetition of the experiment by both the researcher and by fellow professionals. She was very conscious of the contrast between this scientific paradigm and that of educational research where the methods of the social sciences are more commonly used, data is frequently qualitative and subjectivist interpretations of social reality are made. Although the most appropriate methodology for the investigation appeared to be case study, the researcher was cognisant of the criticisms of this approach, succinctly highlighted by Borg (1963)

> Perhaps the major reason for the slow and unsure progress in education has been the inefficient and unscientific methods used by educators in acquiring knowledge and solving their problems. An uncritical acceptance of authority opinion that is not supported by objective evidence and an over-dependence on personal experience have been characteristic of the educator's problem solving techniques.
> (Cohen and Manion, 1994:5)

As a check to the possibility of purely subjectivist approach, objective evidence was also sought, wherever feasible. Data collection was in two parts:

- a detailed case study of four schools; the schools chosen to provide comparison and contrast of subjective results
- a postal survey was conducted to set the case study findings in a wider context and address the issues of the validity and reliability of evidence
- by using several methods for data collection in the case study, triangulation of data was made to further validate results.

Finally, the researcher considered it important to address the issues raised by Copley and Williams (1993) concerning the impact of the use of technology to effect change within the classroom. Despite the emphasis on the importance of technology in many content areas, they found little evidence of its use producing change in classroom organisation or the implementation of innovative methods. They stressed the need for the gathering of such evidence through the use of observational methodology, stating that:

> If we are studying the integration of technology in the classroom, we need to know if in fact technology is being integrated into the classroom. That cannot be evaluated unless observations of classroom events are actually made.
> (Copley and Williams,1993:119)

3.1 The research domain

After careful consideration, the methodology chosen was basically a case study of four schools, two with, and two without, units for pupils with special needs. These schools were located in two large, adjacent Local Educational Authorities (LEAs). Basic information on the schools is shown in table 3.1. Two were on adjacent sites whilst the other two were some distance apart. However, as the researcher was working as an advisory teacher across the whole area, this geographical spread did not pose a problem. As the researcher was well known to these schools, there already existed an informal, open relationship between herself, staff and pupils.

Table 3.1 Information concerning the four case study schools

School	A	B	C	D
Age Range	Junior C of E Aided	Primary JMI	Junior	Infant/Nursery
Catchment	Large, expanding village with mainline station to London	Privately owned residential area on the outskirts of a London suburb	Mixed residential area on edge of shire county town	Mixed residential area on edge of shire county town
Number of Classes	8	8	12	9 Infant + 2 Nursery
Units	1 SEN	none	1 Hearing Impaired	1 infant + 1 Nursery Hearing Impaired
Classroom type	Open Plan Unit in quiet room	Semi-Open Plan - 2 class bays	2-storey traditional classrooms	single storey traditional classrooms
Number of Computers	15 school 4 unit	17	12 school 3 unit	11 school 3 units
IT co-ordinator	Headteacher until recent change to classteacher	Headteacher	Classteacher for main school 2nd i/c UHI for unit	Classteacher for main school Head of UHI for units
Notes	Headteacher very experienced in I.T. School is now seeking GM status	Headteacher very experienced in I.T. 'At leading edge of educational IT' OFSTED	'....scope for improvement in I.T.' OFSTED	Both I.T. co-ordinators very experienced in IT

In addition, all four schools welcomed an investigation into the way they were using multimedia technology with their pupils.

The schools were chosen by the researcher to :

- be examples of 'good primary practice' - though not necessarily in IT
- have the necessary multimedia hardware/software in use in the school
- cater for pupils with a range of abilities including those with special needs
- reflect a range of experience and expertise in the use of the technology

However, although the schools appeared well chosen to enable the researcher to address the research questions, she was unsure whether they were a representative sample of primary schools who were using multimedia technology, or not. When considering such multiple case studies, Yin (1984) discussed the use of replication, not sampling logic and the need to differentiate cases producing literal replication (similar results) and those providing theoretical replication (different results for predictable reasons). The researcher felt that a survey of a larger number of schools was needed to establish a data base of information with which the case study schools could be compared and contrasted. However, with the resources at her disposal, a postal survey appeared to be most feasible. In order to ensure that all of the schools surveyed were already using multimedia technology, the group chosen were the 134 schools with postal addresses in the chosen counties who had received multimedia systems under the 1994 DfE CD-ROM in Primary Schools Initiative. Since the equipment was free, this survey was not restricted to those schools able to fund such expensive technology. However, each LEA was allowed to decide upon their own criteria for this provision. These criteria are not made public but empirical evidence from past initiatives appeared to show differences from one LEA to another. To address this issue the researcher chose to survey all schools with postal addresses in the two shire counties, since this area actually encompassed a number of local education authorities (LEAs). In this way, the researcher hoped to remove anomalies caused by individual authorities' interpretations of the DfE initiative, as well as

providing information on the use of multimedia across all three possible computer platforms. This latter information proved most important since all three platforms were used in the study schools due to the non-arrival of one system.

3.2 Choice of case study schools

Information from the survey revealed that the schools chosen for the case study provided a representative sample of the age range and classroom organisations reported by the survey schools. They also represented a similarly wide range in expertise and implementation of multimedia technology. Schools A and B had been used by the researcher for a previous study of the use of multimedia technology (McDevitt, 1994) and were towards the 'leading edge' of the spectrum whilst schools C and D were further down this continuum. In choosing the schools, the researcher anticipated that the results of observations of two 'experienced users' could be compared and contrasted with two less experienced users. In compiling the survey, the researcher discovered that, in fact, schools A, B and C had all embarked on the use of multimedia technology at approximately the same time, but with very different results. In practise this meant that, the schools' levels of experience were unchanged from that anticipated. However, by analysing the results of observations in those schools the researcher hoped to discover at least some of the reasons for these differences.

Since part of the research question involved the effects of the use of this technology on pupils with special needs, schools C and D both had units for hearing impaired children within the schools. An additional reason for choosing these particular schools was that the units used the same method of communication (Total Communication) since the researcher felt that this reduced one of the possible variables. Although the effects of communication method on the use of multimedia technology could prove of interest to educators of the deaf, the researcher felt that this was outside the constraints of this study.

When it became clear that the unit of school D would not receive a system at all, the researcher considered using an alternative school for the case study. She considered alternative schools, with Units for Hearing Impaired, who already had the necessary technology but found that they did not meet the other criteria as well as school D. As the main investigation concerned the mainstream school, who *had* received a system, and the University was able to loan a system to the unit of school D, the researcher decided against changing schools. In making this decision, the researcher was aware that this loan machine was both older and used a different platform from those used by the other schools. However, staff in the unit were already familiar with the platform and the same CD-ROM titles were available for that operating system. What could not have been anticipated was the extent to which the speed of the processor, memory and monitor size would limit the range of titles that could be used, in practice, on this machine. Despite these limitations, the researcher considered that she was still able to make useful observations of the way in which CD-ROM technology was being used within a specialist unit setting, although direct comparisons with other schools were not be possible.

Multimedia technology offers pupils information via a range of sensory channels. However, it was not known whether this multi-channel input would prove advantageous or detrimental to those who could not access all of those channels. Pupils with special needs are often unable to access at least one these channels. The researcher chose to use pupils with hearing impairment since the sensory channel 'least accessible' would be consistent, although the extent to which it was inaccessible varied amongst individuals. The choice of the case study schools appeared to offer contrast between two schools with and two without pupils where such differences could be observed and analysed.

Pupils with hearing impairment are integrated into the mainstream classes in a number of primary schools. The researcher considered using such schools for the case study. However, there are rarely more than one or two such pupils in any one school. Also, these pupils may not provide a representative sample of the range of

hearing, and consequent language, impairment. By using schools with attached units, the researcher was able to observe pupils with a wide range of hearing loss. An additional reason for choosing those particular units was that, although nominally on the register of the units, pupils are integrated into the mainstream classes for part, or all, of the school day, dependent on individual need. Both the units and the mainstream schools had access to multimedia technology and it was possible to observe the uses that were made in mainstream classes with, and without, integrated hearing impaired pupils, as well as the uses made of the technology within the specialist unit situation.

As can be seen from Table 3.1, school A had set up its own 'unit' for pupils with special needs, funded by the school, not the LEA. As discussed later, the pupils and criteria for their presence in the unit was very different from those of schools C and D. This offered additional possibilities for comparison and contrast of the use of multimedia technology.

3.3 The case for classroom based research

Yin (1981a) defines a case study as

> an empirical enquiry that
> - investigates a contemporary phenomenon within its real life context;
> when
> - the boundaries between phenomenon and context are not clearly evident; and in which
> - multiple sources of evidence are used
>
> (Yin,1981:23) (original punctuation)

A case study approach was adopted by the researcher for three main reasons. Firstly, although multimedia technology was being introduced into primary schools, teachers had little idea regarding the uses that could be made of this technology or the changes that its introduction could/would make to the delivery of the curriculum. Although the National Curriculum, at that time, provided guidance on *what* should be taught, it did not indicate *how* this should be achieved. A small scale study was seen by the researcher as a vehicle for illuminating the problems (and solutions) involved in the implementation of this innovation and the methods used by schools to

integrate the use of this hardware and software into their delivery of the curriculum, including the changes made by its introduction into that delivery. An additional aspect of this innovation was that it provided pupils, for the first time, with multi-channel access to information. However what was not known was whether this was advantageous or disadvantageous to those who could not access the full range of those sensory channels. Russell (1995) identifies this as the 'gee whiz factor' associated with the introduction of IT innovation and suggests that this will always be present in subsequent IT initiatives.

Secondly the Schon Centre-Periphery model of social change (Schon, 1971) provided the conceptual framework for the dissemination of this innovation and hence of this research. Although originally applied to economic growth, it was later seen as pertinent to view the school as a complex 'Total' institution using Goffman's (1961) criteria. It was the model used by the Micros In Schools Scheme in 1981 and although its shortcomings were pointed out by a number of researchers (Russell 1988, Bennett 1994, Maddux 1993) this was still the model used by the DfE for the CD-ROM in Primary Schools Initiatives of 1994 and 1995. However, by using this model as a starting point, the case study approach could shed light on the way the technology is organised, managed and used as well as the INSET/innovation factor identified by Russell (1995).

Thirdly, by looking in detail at the use of this technology in a small number of institutions over an extended period of time, the researcher was able to observe how the use of the technology changed as well as the changes it made to the delivery of the curriculum. In this way she has attempted to highlight the strengths and weaknesses of this implementation with a view to enhancing the learning process which Maddux (1993) suggests should be the changed focus for educational IT research as we move towards the millennium.

Observations were made in each of the four schools on average two or three times each month over a four term period. Each visit usually lasted for up to half a school

day but was on occasion reduced to half that time, dependent on the availability of both the researcher and the pupils. However during the 'usual' period, observations would be made of several different groups of children, both within the same class and of different classes, dependent on the use that was being made of the multimedia computers on that day. From the initial contacts with the school, the researcher had emphasised that she wished to observe 'normal' uses of the systems. Visits were arranged in advance with all of the schools but no attempt was made to arrange regular fixed times and days. This was particularly important in school B where use of the multimedia systems was timetabled and the researcher aimed to observe as many different children as possible.

3.4 The role of the researcher

Cohen and Manion (1994) define two forms of observation as participant and non-participant. Ideally, the researcher aimed to be a non-participant observer. However, she found in practice that as Bailey (1978) explains:-

> In a natural setting it is difficult for the observer ... not to act as a participant... *and concludes that...* Most studies in a natural setting are unstructured participant observation studies.
> (within Cohen and Manion, 1994:127)

This phrase 'unstructured participant observer' most accurately describes the researchers role. Many of the educational tasks observed, as well as the software used for them, were previously untried. Inevitably practical problems arose and the presence of the researcher was (hopefully) helpful when such events occurred, particularly when pupils were using the systems outside the main classroom. However, the researcher attempted to confine her participation to a minimum, especially when this might affect the learning outcome.

As detailed in the section concerning the Schon Centre-Periphery Model, many schools were provided with multimedia systems by the CD-ROM in Primary Schools Initiative. However, in the years since the Micros in Schools (1981) project, a free enterprise, market forces-led ethos had entered the world of education. Although one day's training in the basic operation of the machine was provided, little further

guidance was given. A range of CD-ROM titles was provided with each system but these were all standard commercial titles. Schools knew that these titles had been chosen by NCET to be 'good' examples but none had been produced either for the initiative or even, apart from two of the Acorn titles, primarily for use in schools. Since schools were responsible for their own budgets under LMS, they were 'free' to make their own decisions regarding purchasing. Advice was available from LEA or independent IT consultants; but at commercial costings and limited by the number of people with expertise in this very new aspect of educational IT. All four schools were aware that the researcher was an advisory teacher with some knowledge and interest in the use of multimedia and her advice and help was often sought by the schools both with the solving of hardware problems and with the purchase of new software. Although it would be possible to take the cynical view that the schools were obtaining 'something for nothing' the researcher was pleased to foster this informal exchange of ideas as she felt that it helped considerably to build up a relationship of trust between researcher, staff and pupils. Through the vector of the researcher, ideas were exchanged between schools that were unlikely to have occurred otherwise in an educational environment that was encouraging competition, rather than co-operation, between schools.

The researcher was already known to both staff and pupils of the four schools. Although she always made appointments, in advance, with the schools, these were deliberately chosen to be at varying times of the day as well as days of the week. There was an understanding by both school and researcher that she would observe whatever CD-ROM activity the pupils happened to be engaged in at that time. The researcher hoped that this would foster an informal and relaxed attitude to her work in the schools for she was anxious to make observations, without disrupting classroom routine, of ' normal practice', by a range of pupils in different situations, over a period of time.

3.5 Observation methodology

Data was gathered by a combination of structured observation, field notes and interviews; the data gathering process was itself structured into three main groups:-

1. Initial interviews with IT co-ordinator and/or Headteacher to discover the school policies with regard to IT, study skills and information gathering/ presentation in the schools. Their current situations with the use of multimedia technology and their future plans were discussed. From this decisions could be made regarding observational visits, recording methods etc.

2. Observations of pupils using the technology for a range of activities including information gathering. The results of observations of different groups of pupils engaging in the same multimedia activity were able to be compared and contrasted. These were generally in the same school but for some 'popular' titles, the same CD-ROM was observed being used by pupils in different schools. This was contrasted with observations of the same (or similar) activities using traditional sources.

   Whenever possible, both pupils and staff were interviewed using a standard set of questions. Even when the system was operated within the classroom, the researcher often found it more convenient to accomplish this task with teachers during break times. As the discussion could range wider than the confines of the standard questions, additional notes were taken.

3. Triangulation of data was achieved using more formal interviews with staff and pupils using a prepared questionnaire to validate results.

3.6 Methods used to record observational data

The observational data was gathered using prepared diagrams with additional field notes. In a previous CD-ROM project (McDevitt,1994) the researcher had discovered the need to keep track not only of the pupils' behaviour but also the CD-ROM activity. As she is also hearing impaired, it is essential that the researcher's eyes spend minimal time away from the pupils under observation! The only method she found feasible was the use of simple diagrammatic checklists. Both diagrams were devised by the researcher based on standard observational methods. The researcher had considered the use of a 'ready made' system such as those reproduced in Galton (1978) but developed her own diagrams as shown in Appendix 4. These were effectively 'piloted' during that earlier project and were further refined during the current research.

Using form 1, the researcher recorded the behaviour of the pupils (approx.) every two minutes. From these records, it was hoped to be able to observe common patterns of behaviour and perhaps to suggest reasons for such observed events.

Marshall (1991) includes two case studies and accompanying worksheets concerning the logical paths used by primary pupils to find information from a CD-ROM. From personal experience, the researcher was unsure that the task was always as simple as might be hoped. In McDevitt (1994) the researcher had observed unexpected effects such as; splitting the contents page across two letters prevented some young children from finding the information they required. She had also observed that some pupils tended to stay strictly to the task whilst others used the supposed 'power' of the CD-ROM to browse around the pages. Form 2 was devised to enable her to keep a more structured record of the moves made by pupils engaged on information gathering tasks. This form was a revised version of one previously used by the researcher. It was also found to be sufficiently flexible to be used to track the actions of pupils using the CD-ROM for familiarity and reading exercises. The researcher consider devising a form for observation of reading activities. However, since she usually had no advance knowledge of the CD-ROM titles to be used by the pupils

under observation, the use of two flexible, well-known forms was found to be more practical.

3.7 Use of technology to record data

Due to the researcher's own disability, she made only occasional use of a Dictaphone to record brief field notes. These were generally no more than personal memos to remind the researcher to bring information/CD-ROM titles to the school for the next visit. Where they were not strictly part of the research program, these memos were not transcribed. However, the researcher actively sought an alternative, and corroborative, method of recording pupils' use of the CD-ROMs. The existing recording diagrams enabled her to record the on-screen actions but it would have been helpful to find another method of recording the children's reactions, conversations, as well as the interaction between the mouse controller and the rest of the group. A possibility that suggested itself to the researcher was the use of video. She felt that this would be of particular value with the youngest hearing impaired children where communication was often purely using facial expression and sign. Video is widely used in the Unit of school D as a record of children's' progress and achievement as well as to record events, visits etc. for later recall and explanation. The pupils are well accustomed to the presence of video cameras so this unit appeared to be best placed to trial such work. However, she found difficulty in placing a video camera unobtrusively in a suitable position to record both the faces and hands of a group of children. This was partly due to the fact that, apart from school A, all the computers were operated against a wall, which left little space for the tripod and video camera. Due to the large classroom in the unit of school D, it was possible to move the computer trolley into a better position in the room but the researcher was aware that this would not be practical in other locations, due to lack of space. Then she attended an NCET conference and saw a 'spyball camera' being used to record people using a computer. This appeared to offer a solution to the problem. Although the equipment at that time only operated on a MAC computer, this was the very system in use in the unit of school D where the use of video seemed most apposite. Having discussed this idea with her supervisor, the University were

also keen to experiment with this new recording method and funds were sought to purchase the equipment. As an interim measure, the researcher contacted Mick Thomas of NCET who most kindly lent her this piece of equipment. Unfortunately, the researcher found it to be less helpful than she had hoped. Its use was severely curtailed by the memory (both RAM and hard disc) of the older MAC computer used by the unit of school D. In practice, it was found that, even at the lowest resolution, only one or two seconds of video could be recorded. Further that the available RAM could not support the use of a CD-ROM and the spyball camera! All the available CD-ROM titles were tried but this idea had to be abandoned.

The researcher was still particularly keen to try to record, on video tape, the use of the CD-ROM by one child in the unit of school D who was both deaf and autistic. With the help of the classroom assistant, who is also responsible for much of the video work within the unit, 'traditional' video was obtained of 'John', plus another deaf child, using 'A Silly Noisy House'. Since neither child spoke, the microphone was used by the researcher to record the events on screen. The researcher had observed the communication between the two pupils and had hoped to capture similar events on the video. However, the results were perhaps less 'realistic' than anticipated. As is customary in the unit, the camera set up and left running. The children soon appeared to forget about it. One feature of John's behaviour is his tendency to repeat well known patterns of actions, or rituals. e.g. he always calls up the dream. However, the 'video-ed' use of the CD-ROM did not follow the pattern previously observed. Although the researcher obtained hours of video in this way, neither the researcher nor staff in the unit, felt that the results were representative of 'normal' events. As a result of this trial, the use of video was not extended.

3.8 Overview of the survey

In the design of the survey, the three prerequisites identified by Hoinville and Jowell (1978) were carefully considered by the researcher.

1. the exact purpose of the inquiry
2. the population on which it is to focus
3. the resources that are available.

1. Since the purpose of the survey was to inform the case study, the initial task of the researcher was to identify the questions to be posed in the survey. i.e. What do I want to know and what is the most appropriate way to collect this information?

2. As explained earlier in this chapter, the survey was to be focused on schools that had been provided with multimedia systems under the 1994 DfE CD-ROM in Primary Schools Initiative. This information was obtained from either the relevant local education authority IT Advisory Service or NCET, who were charged with the organisation of this initiative on behalf of the DfE. Although the researcher was able to contact the IT Advisory Services direct for the two main shire counties, the latter source was also needed since the geographical area chosen included parts of several London boroughs. In practise the latter method was also used for one of the shire counties due to the time taken to elicit a response to the request for information.

3. The resources available for the survey both in terms of time and finance were limited. At the time of the survey, the researcher was also working as both a part time advisory teacher and lecturer. The use of a postal survey appeared to be the most practical method to be adopted, especially as the researcher was in receipt of a bursary from the NCET that could be used to cover the cost of postage.

3.9 Survey design

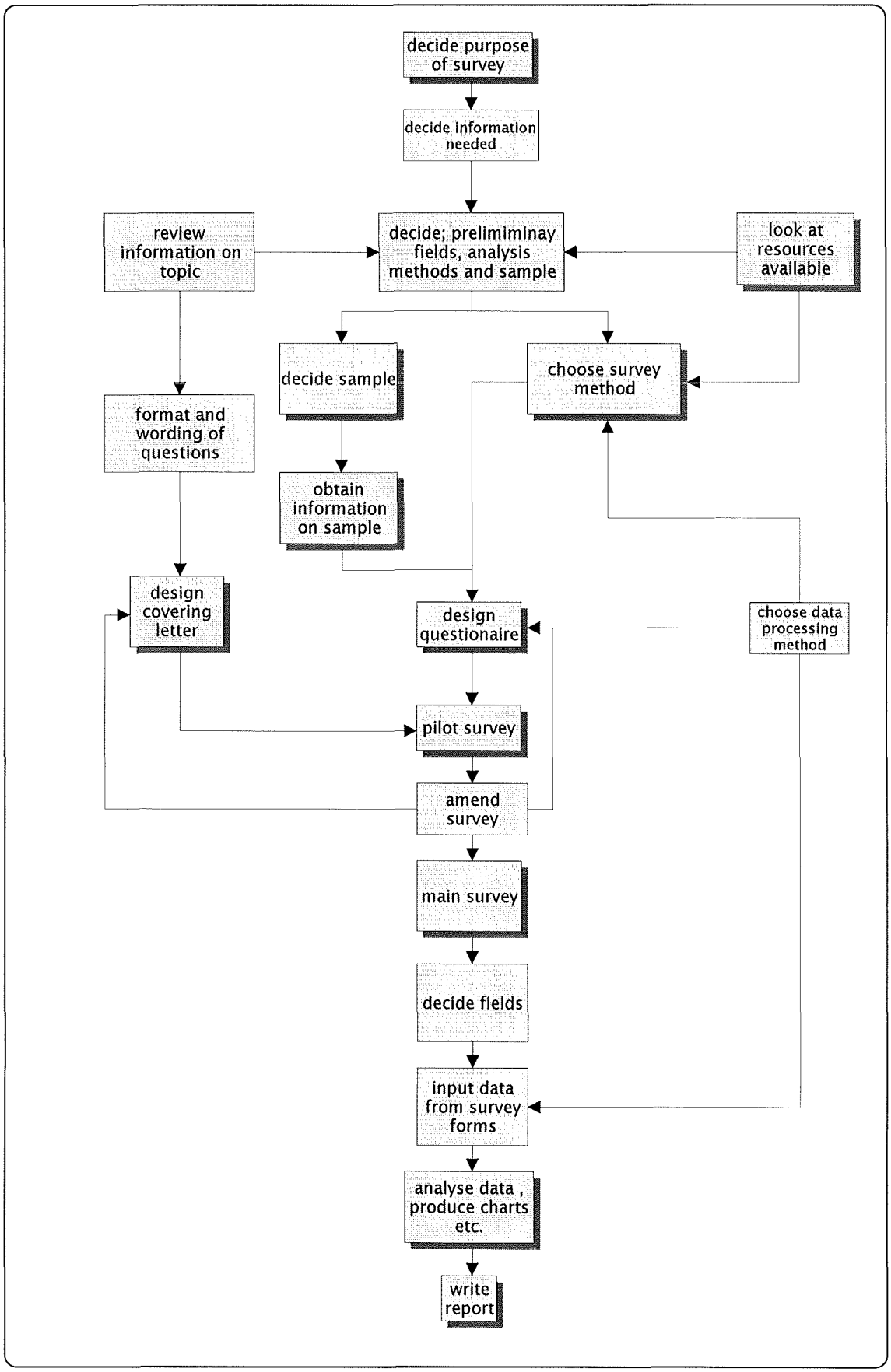
The researcher decided that she needed to discover the following aspects of CD-ROM use from the survey:-

Table 3.2 Aspects of CD-ROM use to be investigated in the survey

Question to be posed	Notes
How many pupils potentially had access to the system	- only one system was provide to each school, regardless of size. Russell (1988) reported difficulties with this for large schools - was this still true for CD-ROM technology
Who actually used the system?	In the schools observed by McDevitt (1994) use of CD-ROMs was restricted to upper Juniors - was this still the pattern?
Where did they use the system?	McDevitt (1994) reported use both within and outside the classroom
What size of groups used the system? Was it always the same?	
Did they add to the provided system?	Although the systems were considered 'complete' no printer was provided since this was not required for previous CD-ROM initiatives in secondary schools - did this experience apply equally as well to primary schools? Did they purchase additional CD-ROMs
Did they experience problems with printing?	Primary children are more used to larger sizes of print and greater use of colour than were commonly produced by the CD-ROMs. Did this present a problem?
Which of the CD-ROM titles provided with the system were actually used?	Did NCET make the 'right' choices?
What features made up a 'good/useful' and a 'bad' CD-ROM title?	
Was this the first CD-ROM system it the school - would it remain the only one?	The Micros in Primary Schools Initiative 1981 resulted in very variable IT purchasing policies by schools. Was this to be repeated?

Although 134 schools were to be surveyed, a high response rate was needed if the results were to reliably inform the case study. The researcher carefully planned the survey, as shown in diagram 3.3. Having identified the questions to be asked, the

Diagram 3.3 The stages in planning the survey (adapted from Davidson,(1970))



researcher considered the aspects of design identified by Hoinville and Jowell to produce high levels of response. In addition, personal experience, as an advisory teacher, recommended the use of the folded A4 'booklet' format. As an advisory teacher, the researcher was accustomed to receiving survey forms that the senders suggested would 'only take a few minutes' - which actually took many hours to complete. Therefore, she wished to ensure that her own survey was as simple to complete as possible, yet would provide the essential information she needed. One of the potential sources for tedious copying was names of the CD-ROMs used by the schools. Fortunately, since both the CD-ROM titles provided for each platform and the platform provided to each school were known, it was possible to provide each school with an individualised survey form that only required recipients to tick boxes. In many cases, the name of the IT co-ordinator was also known so the form could be directed to this person, rather than add to the mail of busy headteachers.

Draft versions of the survey form were discussed with colleagues and the researcher's supervisors. Thus three pilot forms (one for each platform) were produced which were piloted with appropriate schools and teachers that the researcher encountered as part of her work as an advisory teacher. As a result of this pilot, the final designs were produced, as shown in appendix 2.

As suggested by Cohen and Manion (1994), the covering letter was to be sent with the survey booklet. As shown in appendix 2, the practices they recommend were adopted. Finally, the survey package also included a stamped addressed return envelope.

In their recommendations for initial mailing practices, Hoinville and Jowell (1978) identified the importance for the timing of the survey. At the time of the survey, it was common practice for the first day of term to provide staff with time for administration as well as training in some area of the curriculum. The researcher considered that this offered a window of opportunity to increase the return rate of the survey forms. Thus, the survey packages were sent to schools during the latter

part of the Christmas holiday. Although the exact date of the start of the new term varied from one LEA to another, the researcher anticipated that the survey form would appear in the IT co-ordinator's mail on that first, least stressful, day of term.

The results of the returned survey forms were transferred to a standard database program (Dataease for Windows) from which most of the searches, graphs and diagrams shown in chapter 4 were produced. Some of the more complex diagrams were created using CorelChart or Charts Now. Finally, the results of the survey were compared and contrasted with those found in the case study schools.

One of the surprising finds from the survey was that the most popular CD-ROM title was Encarta. Due to the limitations of the survey, the researcher was unable to glean from the questions posed, the purpose to which it was used. From personal experience, the researcher felt that the text was quite difficult for such young children. She therefore checked this using standard readability scales as shown in appendix 3. Since it was not feasible to poll all of the survey schools to discover how they used this particular title, the researcher took the opportunity to observe its use, whenever the possibility arose, both through structured observation in the case study schools and also in an unstructured way as part of her work as an advisory teacher.

3.10 Triangulation of data

Observational data was collected from three main sources as shown in Fig 3.4a :

1. the researcher's observations

2. interviews and discussions with teachers, with particular reference to their intentions and perceptions of the children's use of the multimedia computer and anticipated learning outcomes. During the period of the research, some of the schools were building up guidelines for staff in the use of the CD-ROM titles within the National Curriculum which provided additional documentary evidence.

3. interviews and discussions with pupils, usually in a group setting immediately following their use of the computer. Generally this was in the absence of the teacher, again with particular reference to the pupils' perceptions of the purpose and outcomes of their use of the multimedia computer.

All of the CD-ROM titles were observed being used by more than one group of pupils.

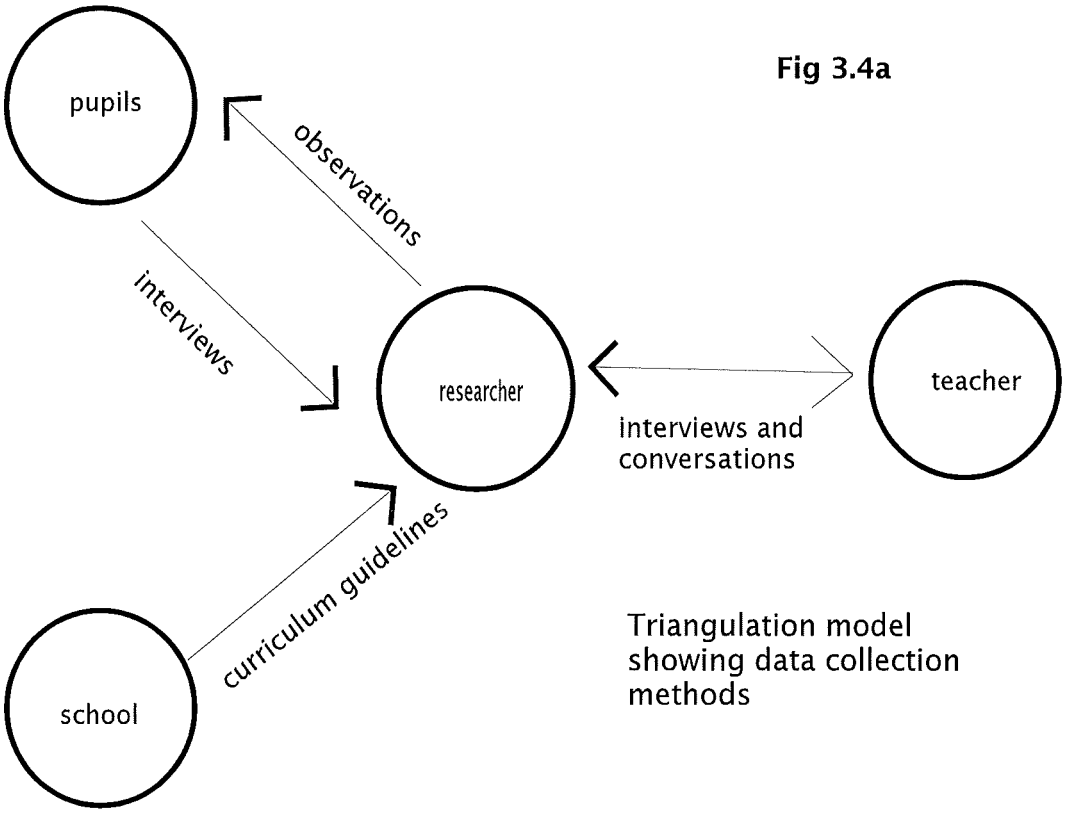
Where observations were made of children engaged on tasks using traditional methods of information gathering, a very similar approach was used with data again being collected from the same three sources.

This method of data collection falls within the framework of triangulation. Denzin (1970) discussed the main types of triangulation used in sociological research. His category of investigator triangulation best describes this particular enquiry where the researcher is one part of the triangle completed by teachers and pupils in the supply of source data. This form of triangulation was used by Elliott and Adelman (1976:74) which they described thus:

> Triangulation involves gathering accounts of a teaching situation from three quite different points of view; namely those of the teacher, his pupils and a participant observer..... The process of gathering accounts from three distinct standpoints has an epistemological justification. each point of the triangle stands in a unique epistemological position with respect to access to relevant data about a teaching situation. The teacher is in the best position to gain access via introspection to his own intentions and aims of the situation. The students are in the best position to explain how the teachers actions influence the way they respond to the situation. The participant observer is in the best position to collect data about the observable features of the interaction between teachers and pupils. By comparing his own account with accounts from the other two standpoints a person at one point of the triangle has an opportunity to test and perhaps revise it on the basis of more sufficient data.
>
> (Elliott and Adelman,1996:74)

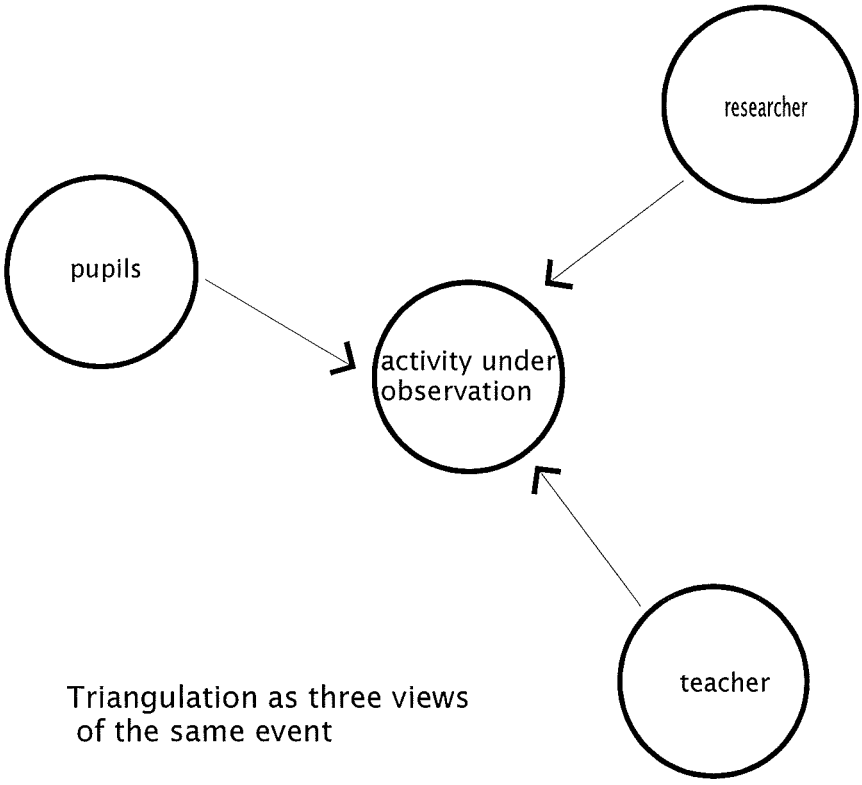
Triangulation Models

Fig 3.4a



Triangulation model showing data collection methods

Fig 3.4b



Triangulation as three views of the same event

For some titles, it was possible to observe the same CD-ROM being used by pupils in more than one school. Such occurrences were used for further triangulation of observations as they could be said to fall within Denzin's (1970) definition of 'space triangulation'.

Cohen and Manion (1981) caution researchers of the dangers of relying on a single method of data collection and recommend the use of what Denzin (1970) refers to this as methodological triangulation as follows:-

> Exclusive reliance on one method may bias or distort the researcher's picture of the particular slice of reality he is investigating. He needs to be confident that the data generated are not simply artefacts of one specific method of collection. and this confidence can only be achieved as far as normative research is concerned where different methods of data collection yield substantially the same results. Further, the more the methods contrast with one another, the greater the researcher's confidence. If, for example, the outcomes of a questionnaire survey correspond with those of an observational study of the same phenomenon, the more the researcher will be confident about the findings.
>
> (within Cohen and Manion,1994:269)

Although data concerning 'how' and 'why' CD-ROM titles were used in schools was obtained by observation and triangulated as explained in the previous section, the researcher obtained data concerning 'what', 'where' and 'with whom' from the both the questionnaire survey and observation in the case study schools.

3.11 The Schon Centre-Periphery model

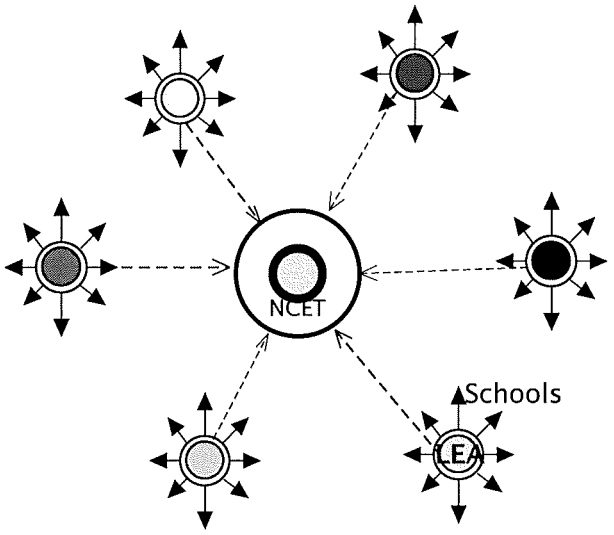
DfE Initiatives to place a large number of complete CD-ROM computer systems into primary schools took place over approximately a two year period. For the purposes of the research, such an initiative has been seen by the researcher as an innovation. By adopting this view, it is possible to apply a model for the process of supplying hardware and software to the schools. In examining the way in which the innovation of micro-computers was disseminated to primary schools in the early 1980s, Russell (1988) applied an adaptation of the Schon Centre-Periphery model. Having examined alternatives, the researcher feels that this basic model still best describes the DfE CD-ROM Initiatives of 1994 and 5. The model requires different adaptation to fit the

changed educational climate but perhaps because both initiatives were serendipitous and executed very rapidly, the Centre-Periphery model still appears to the researcher to provide the best descriptor. Schon described the model as follows:

> This model rests on three basic elements: The innovation to be diffused exists, fully realised in its essentials, prior to its diffusion. Diffusion is the movement of an innovation from a centre out to its ultimate users. Direct diffusion is a centrally managed process of dissemination, training and provision of resources and incentives. Advocates of centre-periphery theory have tended to see diffusion as' the human interaction in which one person communicates a new idea to another person. Thus, at its most elemental form of conceptualisation, the diffusion process consists of (1) an new idea, (2) individual A who knows about the innovation, and (3) individual B who does not know about the innovation.
>
> (Schon,1971:81)

Schon considered that the effectiveness of the simple centre-periphery system depended upon the level of resources and energy at the centre, the number of points at the periphery, the length of the spokes through which dissemination takes place and the energy required to gain new adoption. In order to extend the limits and overcome the sources of inherent failure of the simpler model, Schon proposed a proliferation of centres. In this model, the secondary centres engage in the diffusion of innovation. When computers were introduced into schools in the early 1980s, many agencies were involved. These acted as secondary centres to central government, but as primary centres for diffusion of the innovation to schools. Over the following ten years, the level of resources and energy at the centre greatly diminished, as did the number of secondary centres. The introduction of widespread LMS, and Grant Maintained schools had greatly diminished feedback between centres, both primary and secondary. This, together with a free market educational climate led to the fragmentation of the system. The Schon model predicts that within such a failing centre -periphery system, some secondary centres will decline whilst others gain independence. However, the message delivered by these remaining secondary centres can be expected to vary according to local conditions. The researcher considers that this model very accurately describes the educational IT situation just prior to the 1994 CD-ROM in Primary Schools Initiative.

Fig 3.5 The Schon Centre-Periphery model with proliferation of centres adapted to represent the diffusion of IT innovations by the late 1980s



N.B. The secondary centres (LEAs) are shown in different shades to indicate the variation in central message relayed to their schools.

As discussed in detail elsewhere, the 1994 initiative arose unexpectedly and NCET was charged with the organisation of this welcome, but serendipitous, initiative on behalf of central government. No pre-initiative planning was possible since the fixed some of money allocated to the project was required to be spent within three months of the announcement. Although a second initiative occurred in 1995, both were announced as one-off windfalls to schools and were treated as such. Decisions concerning the hardware and software to be provided were made centrally by NCET, on behalf of central government; the number of systems was simply the maximum number of 'complete' systems possible within the fixed budget. With such a tight time schedule, NCET used the existing LEA IT centres as secondary centres for the diffusion of the innovation. These secondary centres were charged with the allocation of systems to schools and the provision of training (nominally half a day for one member of staff). Independent researchers were engaged by NCET to provided feedback on the initiative to NCET, as the primary centre. Unlike the introduction of computers into primary schools in the early 1980s, no money was available to provided further advice and training for schools. However, as predicted by the Schon model where the primary-secondary links are weak, the LEA (secondary) centres

interpreted the free training requirements of the project in different ways. e.g. the nominal half day of free training was split to allow for brief initiation of a teacher in the technology as part of a large group in an LEA IT centre but provision of a visit from an LEA advisory teacher to the individual school, some time later, to sort out local difficulties. However the availability, extent, and cost, of additional advice and training to schools was dependent on local conditions.

Although two of the Acorn titles chosen for inclusion in the package were part-funded by an earlier government initiative, the researcher considers that this should not be seen as part of a larger long term plan, more due to the lack of titles for that particular platform!

This initiative appears, to the researcher, to have provided an injection of resources and energy into an existing, if declining, centre-periphery structure. It is this model that she has used as her starting point but has adapted the models proposed by Schon (1971) to take account of the changed conditions. One of these was the presence of commercial and/or independent sources of advice to schools. Amongst the other models for the diffusion of innovation described by Schon, is the Johnny Appleseed Model where the primary centre is a kind of bard who roams his territory spreading a new message. Local government changes in the early 1990s had led to a dramatic decline in the numbers of Advisory Teachers for IT employed by local authorities. Many of these, including the researcher, became, with government encouragement, independent IT consultants who could perhaps be likened to modern Johnny Appleseeds attempting to spread innovations such as the use of CD-ROM technology to schools. However, the climate of severe financial restriction in schools of that time greatly reduced the potential effectiveness of these 'roaming bards' as vectors for change. Despite this restriction in their influence, the researcher feels that their presence should be taken into account when producing a composite model for the dissemination of the innovation of the use of CD-ROM technology into primary schools.

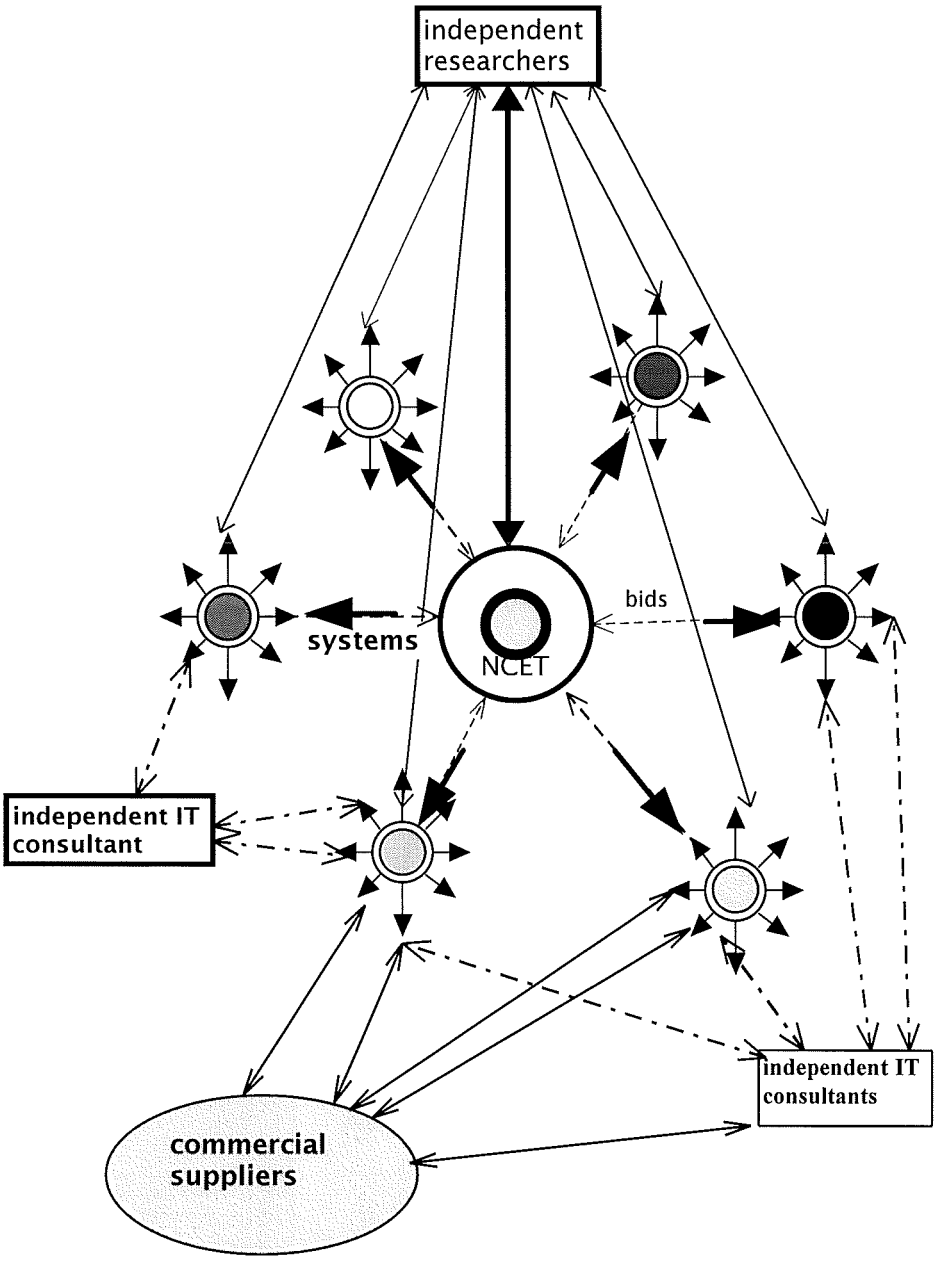


Figure 3.6 A version of the Schon centre-periphery model,adapted by the researcher, representing the diffusion of the innovation of multimedia technology by the 1994 CD-ROM in Primary Schools Initiative

At the heart of figure 3.6 is the same adaptation of the Schon Centre-Periphery model used for the dissemination of the government initiatives of the late 1980s and shown in fig 3.5. As before, the LEAs submitted bids to NCET, who decided upon the choice of hardware, software and number of systems provided to each LEA. These LEAs acted as secondary centres and disseminated the innovation to schools who made bids for the systems.

However, by 1994, changes in educational organisation and funding meant that NCET was no longer the only primary source for the dissemination of the innovation of CD-ROM technology. Schools could also learn of the innovation from independent IT consultants or commercial suppliers who disseminated the innovation using Schon's Johnny Appleseed model. Unlike the LEAs, they were not confined to one geographical area, or standardised ranges of hardware or software. Schools could, if they wished, obtain assistance with the introduction of the innovation from both the LEAs and independent sources.

A final factor in the dissemination of this innovation was the importance seen by both government (via NCET) and outside organisations, both commercial and higher education, for the gathering of evidence concerning the effect of the introduction of such an innovation in schools.

Finally, in examining the development of the centre-periphery model as applied to the diffusion of IT innovation, the researcher was struck by the similarity between the CD-ROM in primary schools Initiative and the injection of heat energy into a closed terrestrial system. The secondary centres could likened to molecules and the schools their constituent atoms. The injection of heat energy leads to an increase in the disorder of the atoms; and entropy is a measure of that disorder. The DfE initiative could perhaps be likened to a massive input of heat energy. By the second law of thermodynamics, entropy increases and order tends to reduce. However, entropy in a closed system is reduced by cooling or removing heat energy; in an analogous way, the potential for additional disorder by the introduction of independent IT advisors

was reduced by the reduction in available funds (energy). However, in constructing her adapted centre- periphery model for the diffusion of the innovation of CD-ROM technology into primary schools, the researcher was reminded of Clausius' re-statement of the second law of thermodynamics 'the entropy of a closed terrestrial system tends to a maximum!'

3.12 Summary

After consideration of the most appropriate ways in which the researcher could answer the research questions posed, she decided upon the following methodologies:

- A postal survey to provide a broad base of quantitative and qualitative information of the ways in which the innovation was being used by a large number of schools. This information could be used to inform the case study and also to set its findings in a broader context

- A case study of four schools, located within the area of the postal survey, to provide more detailed observational data concerning the innovation. Data was recorded using a variety of media, including trialled pro-formas, over a period of four school terms

- Data was to be obtained in the case study schools from at least three distinct sources, thus enabling triangulation of the data to be achieved.

Having decided upon a structure for the study, the next chapter is devoted to a deatiled examination of the postal survey and the results obtained are compared with those of other researchers.Since the purpose of that survey was to inform the case study, the next chapter begins by exploring the relationship between these two major parts of the research.

Chapter 4

The Postal Survey

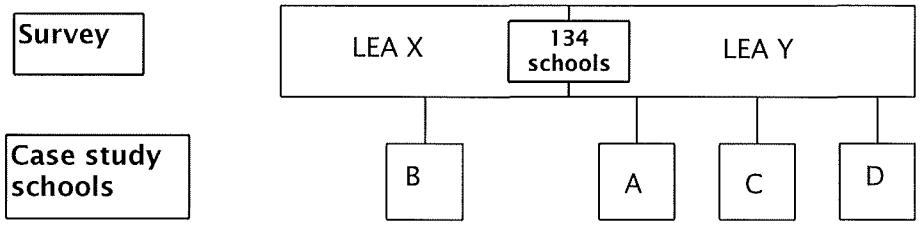
Introduction

The investigation consisted of two separate but interlinked parts:

1. a postal survey of a large number of schools using multimedia technology
2. more detailed observations of the way this technology was being used by a small number of schools.

It was hoped that the survey would provide a broad sweep of information on the use of multimedia technology at one point in time. Data obtained could be used to set the technology in context and to inform the detailed case study.

Fig 4.1 The relationship between the Postal Survey and Case Study Schools



The schools used for the detailed observations were selected to be a representative sample but it was hoped that this could be verified from comparison with the data from the postal survey. These schools were:-

- geographically located within the area of the postal survey
- examples of 'good primary practice' - though not necessarily in IT
- provided with the necessary multimedia hardware and software
- catering for pupils with a range of abilities including those with special needs
- representative of the range of experience and expertise found in the survey

As the case study in these four schools was undertaken over a period of time, it was hoped that observations could be made on how the use of the technology changed over that period. By comparison with the survey data, inferences might be able to be drawn on reasons why these changes had occurred.

This chapter concerns the postal survey of all the primary schools in the geographical areas of two adjoining Local Educational Authorities (LEAs) who received a multimedia system under the 1994 DfE CD-ROM in Primary Schools Initiative. After explaining the size , scope and response percentage of the survey, this section uses the data received to provide information on matters such as:

- the size of the groups using the systems
- the uses that were made of the systems
- the location of the systems
- the use of the CD-ROMs.

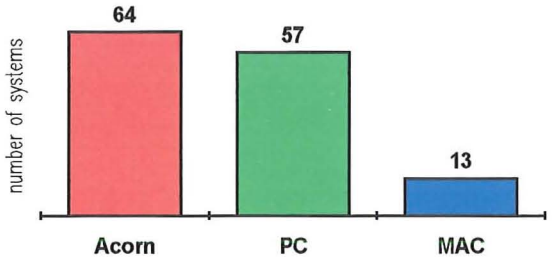
From this base, the CD-ROM titles that schools used most, and least, are examined. The survey responses are then used to offer reasons for these choices. This information was later used to compare and contrast with the findings in the more detailed case study in the four schools.

The chapter concludes with an examination of the schools' assessments of the system with which they had been provided.

The postal survey questionnaire

The purpose of this postal survey was to set the findings of the case study in a wider context. The survey covered all primary schools who received a system under the 1994 CD-ROM in Primary Schools Initiative with a postal address in two large, adjoining shire counties. This area was chosen to reflect the LEAs of the schools used for the case study. This comprised 134 schools with a mixture of all three platforms offered by the Initiative, of which 64 were Archimedes, 13 Apple-MAC and 57 Nimbus PC as shown in Fig. 4.2.

Fig 4.2 Computer systems provided to the survey schools



In general, postal surveys can be expected to have a poor rate of return so the researcher attempted to make the form as easy to complete as possible and to present it in an attractive form as shown in Figs 4.3a, b and c in appendix 2. To achieve the former, as much information as possible was pre-printed onto the form. This resulted in different versions of the basic form being sent, dependent on the platform supplied to the school. In addition, a stamped self- addressed envelope was included. The result was the return of 95 forms, representing a 71% return as shown in Fig 4.4.

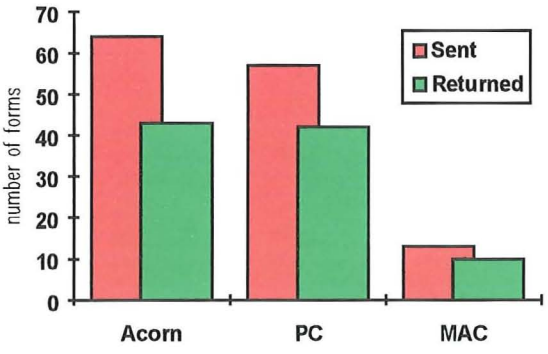


Fig 4.4 The numbers of forms sent and returned for each platform

From the questions posed, the researcher hoped to gain a picture of the way in which CD-ROM systems were being used by a wide range of schools, some of whom would be entirely new to such technology, whilst for others the equipment would represent an extension of existing work.

In fact, as can be seen from fig 4.5, for the vast majority of schools the system represented the first of such in the school. Of the rest, nearly 20% already had, or had recently purchased, one additional system and a very small number of schools had much larger numbers of multimedia systems. Correspondence enclosed with the questionnaires by some of these schools implied that the arrival of the scheme system had provided an incentive to generally upgrade the IT equipment in the school.

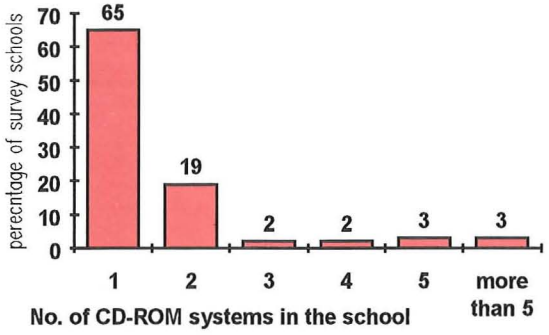


Fig 4.5
The number of CD-ROM systems in a school expressed as a percentage of the schools surveyed

As explained in *CD-ROM Titles Review* (NCETa, 1994), each system was supplied with a range of CD-ROMs chosen after an evaluation process involving teams recruited by NCET from NAACE, MAPE and OFSTED. In this way, it was hoped that the evaluations were carried out by people with a wide range of primary classroom experience. The evaluators also worked in pairs to common criteria as follows:

- the adequacy of both content and coverage
- the appropriateness to the National Curriculum in England
- The appropriateness of Reading Age to KS1 and KS2 pupils
- the quality of the interface design, presentation, degree of interactivity and range of facilities
- the overall quality of support materials (where submitted)
- the overall quality of the title

4.1 Group size

Most schools arranged that pupils should use the systems in groups of three or less, with about a third of the total always working in pairs. This correlates with the researcher's experience in the case study and also with the findings of the NCET commissioned evaluation of this Initiative (Collins et al., 1996). This independent evaluation found that 38% of schools reported always using the CD-ROM system in groups of two or more; another 48% reporting that this happened often. Only four out of fifteen hundred schools said that the system was used exclusively by individuals.

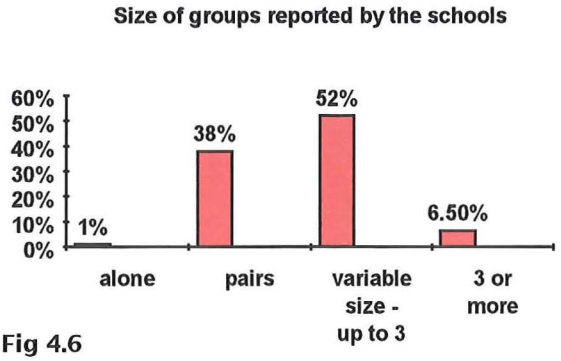


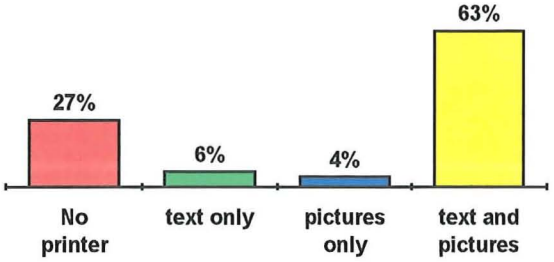
Fig 4.6

4.2 Use of the system supplied

Although the Initiative offered schools 'complete' systems, no printer was supplied, although many of the titles offered a print facility. The survey showed that almost a third of the schools were using their system without a printer. However, hand-written notes on the questionnaires included remarks about the need for a printer, anticipated purchase of printer, and even one with 'the printer's just arrived'!. Size of school did not appear to reflect the availability, or not, of a printer, though the schools without printer were divided almost evenly between the two large LEAs.

In almost all cases, schools with printers, printed out both text and pictures with very few schools printing text or pictures only.

Fig 4.7 The types of printing by the schools



The absence of a printer could affect the use that was made of the system. As might be expected, the titles that these schools used 'a lot' were generally those titles where the print option was irrelevant, such as the reading books. However, there were exceptions and some systems, particularly PCs operated in library/resource areas, were used for a wide range of titles.

Where schools had been able to provide a printer, there was a noticeable dissatisfaction with the quality of the results. From the comments made, it would appear that some schools were using spare printers, such as dot-matrix type, with the systems which would be unlikely to provided high quality results. There was an expectation that the quality of printout would be comparable with the screen, especially where colour printers had been purchased. The researcher had encountered this problem in previous research as reported in McDevitt (1994). Comments were also made concerning the size of the printouts; some explaining their use of image processing software to enlarge pictures, or suggesting that this be provided in future. However, from personal experience, the researcher is unsure whether most primary schools would be able to operate such complex software. Its operation would certainly remove the 'immediate hard copy' option from the majority of primary pupils.

From the researcher's experience as an evaluator in the 1995 Initiative, the print option was not tested by the evaluation team. Obviously the print results would depend greatly on the quality of printer used but perhaps this aspect should be included in the criteria for assessment since it generated such a measure of dissatisfaction.

4.3 Location of system

As the researcher has found from both the case study and wider work in this field, most schools placed the system either within the classroom or a library/ resource area; some did both. Indeed a few schools explained in their return that they were still experimenting with the best position for the system. A Venn diagram has been used in Fig 4.8 to show that some schools operated their CD-ROM system in one type of location only, whereas others varied the location. i.e. 38 schools only reported using their CD-ROM system within classrooms but 59 schools reported its use both in classrooms and in a library/resource area. Collins et al. (1996) reported a similar range of locations for the CD-ROM system. They stated that 36% were placed in shared resource areas whilst 30% were shared between classrooms with another 26% located in one classroom only. Although no figures are given, they also report that ' in some cases more than one location was listed in the school's response' (Collins et al., 1996:16).

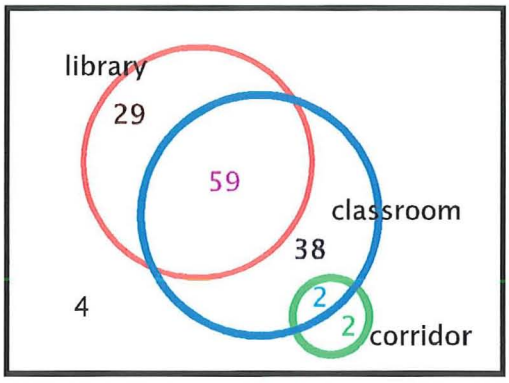
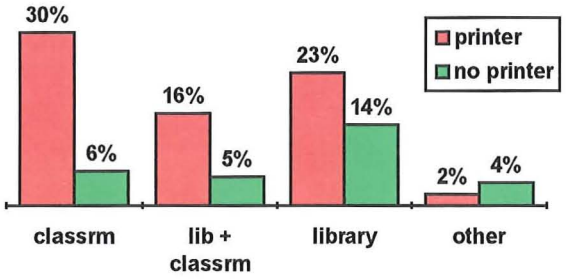


Fig 4.8 Location of the CD-ROM systems

As the researcher had already discovered from a previous case study, the positioning the system could greatly affect its operation (McDevitt, 1994). From this experience, the researcher expected that printers were less likely to be used with the systems operated within the classroom. In fact, the reverse is true. As shown in Fig 4.9, only one fifth of the schools who used the system only within the classroom did not use a printer compared to almost two thirds of the systems operated outside the classroom.

This was an unexpected finding since the researcher had found the noise of the printer deterred its use in this setting during the case study. However, this very large difference implied that there was another factor operating. As the CD-ROM system was 'extra' to the standard school IT equipment, an 'extra' printer would be needed to operate it outside the classroom. However, within the classroom, it might be possible to use the printer that was normally attached to the class computer. Unfortunately this conjecture could not be confirmed from information provided by the survey.

Fig 4.9 The location of CD-ROM systems by schools both with and without printers



It was also noticeable that the pattern of use was different for the systems operated *only* within classrooms. Although certain very popular titles such as the reading books might be used by all classes, in general, schools reported that different CD-ROMs were usually used by each class or year group. Schools who placed the system in library areas generally reported much wider use of each title used. This forced the researcher to question the interpretation placed on the terms used in the questionnaire for use of the CD-ROMs. e.g. a CD-ROM might be deemed to have been used 'a lot' by a school because it had been used 'a little' by a large number of pupils; is this of equal value to the survey as 'a lot' reported by a school who have made very considerable use of the title with one year group only? It is not possible to discriminate between these two using the questionnaire. However, although they do not represent equal usage, the researcher believes that both indicate greater than normal use of the title, which was the information that was wanted.

4.4 Use of the CD-ROMs

A package of CD-ROMs was supplied with each system but the titles, and number, depended on the platform as shown in Figs 4.10 and 4.11.

Fig 4.10 Venn diagram of the numbers of titles and their commonalties

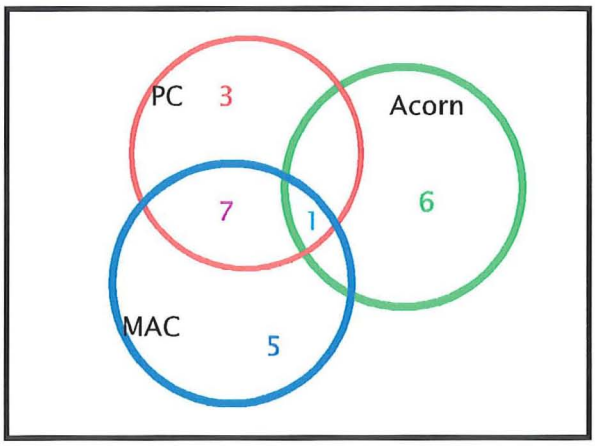


Table 4.11 List of the CD-ROM titles provided for each platform

Acorn	PC	MAC
Creepy Crawlies	Creepy Crawlies	Creepy Crawlies
Frontier 2000	Information Finder	Information Finder
Hutchinson Encyclopaedia	Just Grandma & Me	Just Grandma & Me
Naughty Stories	Mammals Encyclopaedia	Mammals Encyclopaedia
Photobase: Landscapes	MS Art Gallery	MS Art Gallery
Ph/base: Victorian Britain	MS Dinosaurs	MS Dinosaurs
Exploring Nature	MS Musical Instruments	MS Musical Instruments
	New Kid on the Block	New Kid on the block
	MS Encarta	Planetary Taxi
	Anglo Saxons	Silly Noisy House
	Busy Town	Sitting on the Farm
		Tortoise and Hare
		World of Vikings

It is clear that those in receipt of an Archimedes system had a much smaller number of titles than the other platforms and unlike the others, contained no material that was American in origin. One school commented on the form 'wish we'd asked for PC' - though the reason for that remark cannot be ascertained.

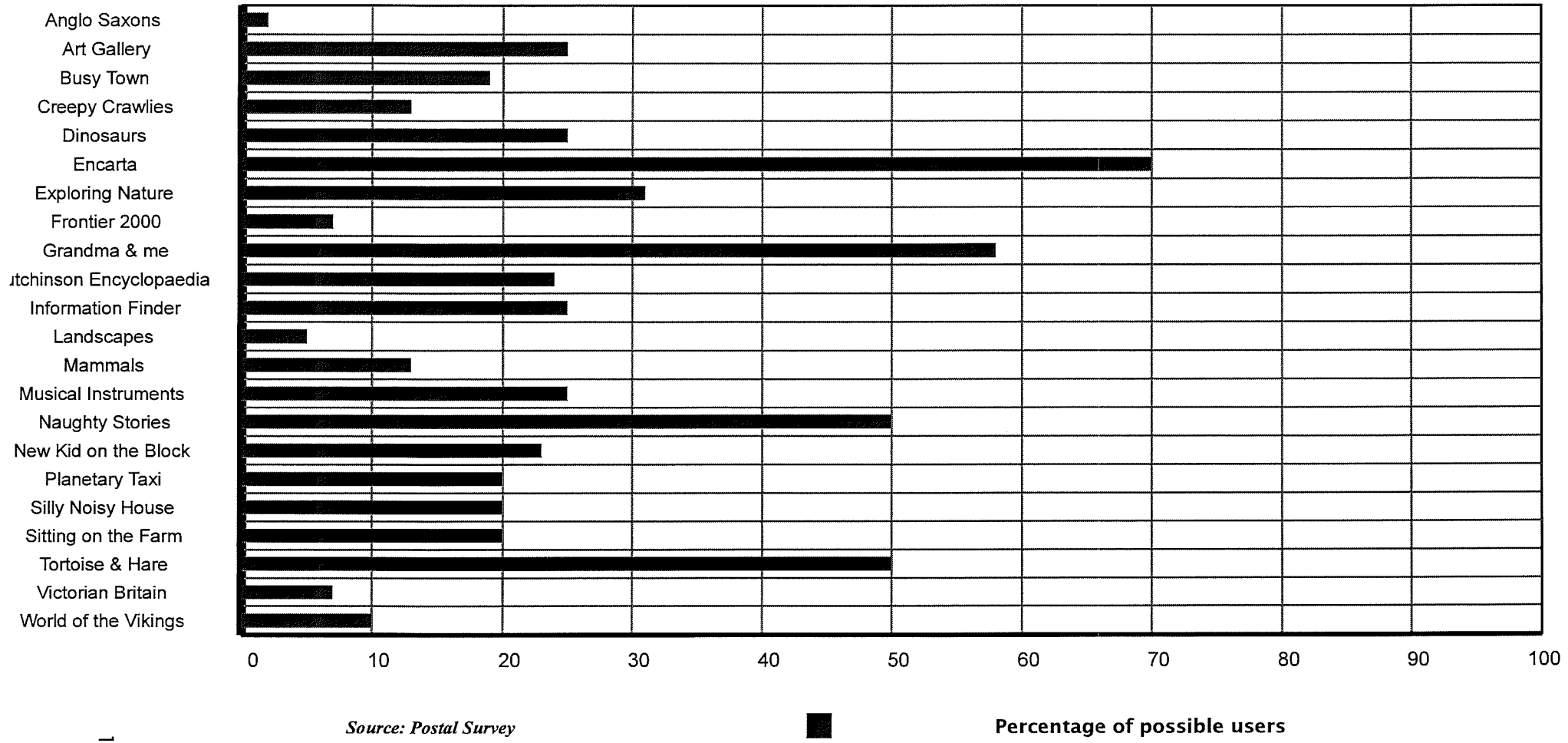
As can be seen from table 4.11 above, only one title, 'Creepy Crawlies', was supplied to all schools but there were several titles that were supplied with both MAC and PC systems. As previously discussed, the CD-ROMs used for the Initiative were chosen from the range of commercially available titles, many of which were American in origin, where both PC and MAC formats are in common use. At that time, it was common for software houses to introduce a new title for whichever operating system they favoured; the commercially successful titles were subsequently made available for both platforms. Thus at the time of the Initiative, Microsoft Encarta was only available for PC whereas Broderbund's Tortoise and Hare was available for MAC only; later these titles were produced for both PC and MAC operating systems. However, use of the Archimedes operating system appears confined to Britain and a few countries with strong educational connections to Britain, such as Australia and New Zealand. Thus the only CD-ROM title that was available for all three operating systems was Creepy Crawlies, being British in origin. This title was produced initially for Archimedes and later made available for the other common operating systems.

As each platform had a different range of CD-ROMs, it is difficult to compare usage. It might be expected that Archimedes users who had only seven titles would use all of them, whereas MAC users with thirteen titles might be spoilt for choice. However, the range of titles used depended upon the suitability of material for the pupils and chosen use of the system within the school e.g. Infant schools with Archimedes systems reported that much of the material was inappropriate - although it was noticeable that they considered titles such as Hutchinson Encyclopaedia to be acceptable to their oldest children (Year 2) whereas such titles were rarely used with this age group by primary schools.

Most schools used a range of titles; only one school had used one title only, Encarta - though this was with every class in the school! Figs 12a shows the titles that schools reported to be rated very good and used most frequently, expressed as a percentage of possible users.

Fig 4.12a The CD-ROM titles used most frequently

shown as a percentage of possible users



Source: Postal Survey

Table 4.12b shows the percentage of schools who received each disc and reported very frequent use by Collins et al. (1996: 20) and compares them with the schools who rated titles as 'very good and used a lot' from the researcher's survey.

Table 4.12b Comparison of frequently used CD-ROMs reported by Collins et al. and the researcher's postal survey,shown as a percentage of possible users

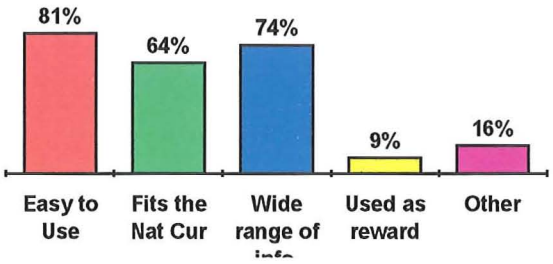
Title	**Used very frequently** from Collins et al (1996)	**Very good and used a lot** from the researcher's survey
Microsoft Encarta	53	70
Tortoise and Hare	48	50
Just Grandma and Me	39	58
Sherston Naughty Stories	35	50
Usborne Exploring Nature	23	31
Hutchinson Multimedia Encyclopaedia	22	24
A Silly Noisy House	19	20
Microsoft Musical Instruments	18	25
New Kid on the Block	16	23
Information Finder Encyclopaedia	15	25
Microsoft Dinosaurs	13	25
Sitting on the Farm	13	0
Busy Town	12	19
Planetary Taxi	10	20
Mammals Multimedia Encyclopaedia	5	13
Photobase: Landscapes	5	5
Microsoft Art Gallery	5	25
Creepy Crawlies	5	13
Picturebase: Victorian Britain	4	7
World of the Vikings	3	10
Frontier 2000	2	7
Anglo Saxons	2	2

The researcher's results appear to show a greater frequency of use of almost all titles but there is a good correlation in the ordering of titles according to use, particularly among most popular titles. However, there is an interesting contrast between the uses reported by both surveys for Microsoft Art Gallery. This very marked difference may represent a preference for this title shown by the IT Advisory Services of the two

particular LEAs used by the researcher. The researcher is aware of its inclusion by one of these LEA Advisory Services in their training for participating schools.

In both surveys, some of the highly specialised titles were the least used. However, this should not be taken to indicate that infrequently used titles were not considered to be of worth. Fig. 4.12c compares the titles rated 'very good' with those that were both 'very good and used a lot'. As can be plainly seen, there were some titles, notably World of Vikings and Art Gallery where there were marked differences between the rating of the title and its actual use in the school. Hand-written notes on the survey forms returned by a few schools indicated that at least some of these apparently less-used titles were expected to be used later in the school year, although reasons for this were not given.

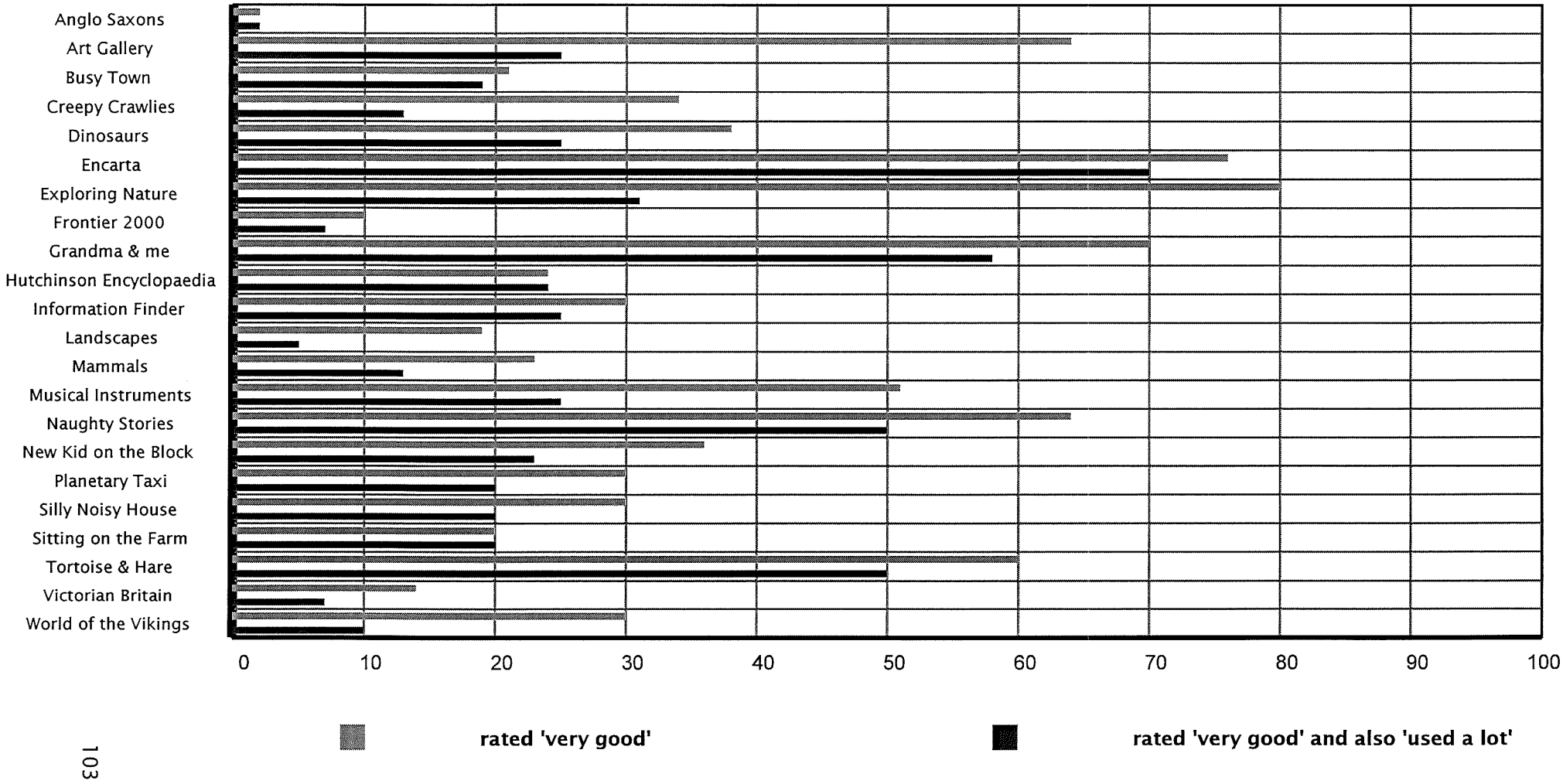
Fig 4.13a The most important qualities of a CD-ROM title reported by schools



However, as shown in Fig 4.13a, schools felt 'ease of use' to be the most important factor in a CD-ROM title. As might be expected, they also preferred titles offering a range of information that could be used within their curriculum. This may help to explain why some of the more specialised titles such as Musical Instruments were highly rated by schools but had received less actual use than the reading books or Encarta. Very narrowly focused titles such as Anglo Saxons or World of the Vikings were often not used at all; where used, it was by one year group in the school. The researcher's supposition that this CD-ROM was being used to support an aspect of the National Curriculum may be reinforced by the comments added to questionnaires by a few schools, such as 'will use later in the year'.

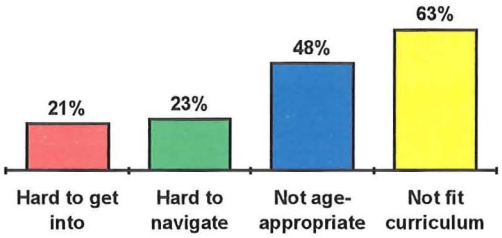
Fig 4.12c Comparison of the ratings of 'very good' with 'very good and used a lot' for each CD-ROM title

shown as a percentage of possible users



The two Photobase CD-ROMs supplied with the Acorn systems were also little used. Unlike the other material, these were purely collections of pictures around a given theme (Landscapes and Victorian Britain). Although these could be used in conjunction with other software for desktop publishing, creation of multimedia presentations etc. by the more computer-competent, the responses indicate that they were not as useful to most schools as the CD-ROM titles that could be used alone. Several schools reported faults with these discs or 'problems printing out' which could indicate that schools did not know how to manage this type of software. Although !Paint is supplied free with the Archimedes system, many schools would not have used it, nor perhaps realised that !Paint (or similar software) was needed to achieve more than a small picture on the screen.

Fig 4.13b The qualities of the least-used CD-ROM titles

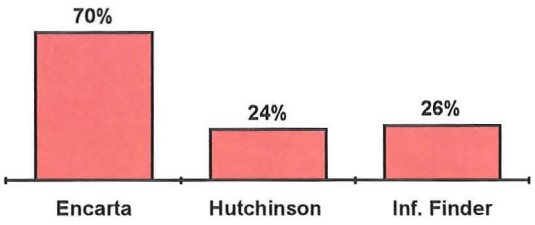


As shown in fig 4.13b, the most important descriptor of the 'least used' CD-ROMs was that that it 'did not fit within the curriculum'. Although 'suitability for the age group' was also influential; difficulty of navigation was less often considered to deter use. However printing problems and 'boring content' were reported by schools to influence their choice of CD-ROMs. These schools did not enlarge on their interpretation of the adjective 'boring' but it is noticeable that the most frequently used CD-ROMs offer a range of media and present information using innovative, immediately accessible and eye-catching ways.

As can be seen from figs 4.12a,b,and c, Encarta was the most popular title. Some 70%, of those to whom it was supplied, felt it to be both very good and also used it a lot - although comments were made concerning the readability of the text. This remark is endorsed by the researcher who obtained Readability scores of 15.3yrs (Flesch), 19.8 yrs (Fog) and 17.7 yrs (Smog). (see appendix 3) The researcher has noticed that this, quite complex, text has been much revised for later versions of

Encarta, some of which include facilities for access to simplified, larger font, text. This particular title was much more popular with schools than others of the same genre. Fig 4.14 shows the percentage of possible users who rated each CD-ROM encyclopaedia both 'very good' and ' used a lot'. Encarta was only available to PC users, yet Information Finder (MAC and PC) was much less popular. However, this figure of 26% includes PC users who had a choice of encyclopaedia. Acorn users only had access to the Hutchinson Encyclopaedia. Although this title was used a lot by some 44% of the possible schools, only 24% also rated it as 'very good'. This bears out the experience of the researcher who found, during a previous case study (McDevitt, 1994), that this title proved less useful than schools had expected.

Fig 4.14 CD-ROM encyclopaedias rated very good and used a lot, shown as a percentage of possible users



The suitability of all of the CD-ROM encyclopaedias for use by primary pupils was commented upon by schools. Although Encarta was generally liked, it had a definite American bias, often quoted as having 53 entries on Boston, Mass. and nothing on Boston, Lincs. Schools indicated that they had purchased alternative titles such as the Kingfisher Micropaedia or were looking for 'Junior Encarta'. Manufacturers have also noted this need since a number of titles have since been released which aim to address this market. The researcher was able to observe the use of some of these titles as part of the case study, described in detail in chapter 6.

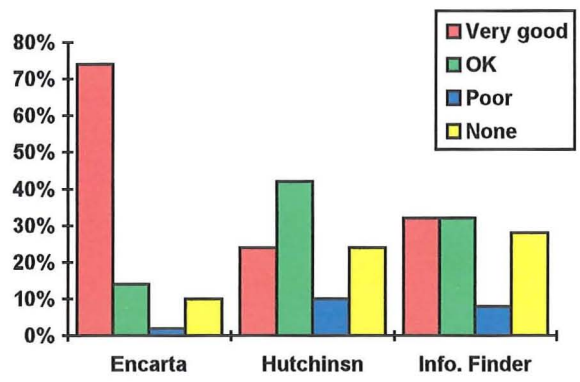
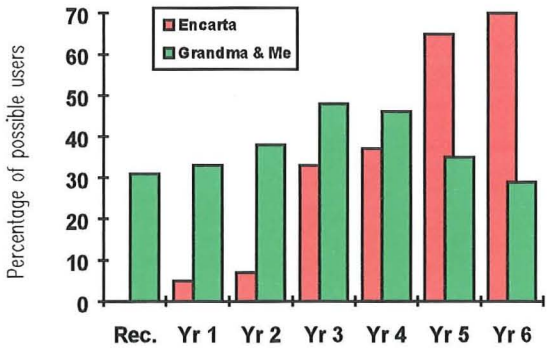


Fig 4.15 Comparison of the ratings of Encarta, Hutchinson and Information Finder, expressed as percentages of possible users

With few exceptions, the encyclopaedias were used by the oldest children only, whereas the reading books were used across the whole age range. as shown in Fig 4.16. This was perhaps because they are the simplest to operate and could be used as a starting point by the less confident.

Fig 4.16 The use of Grandma and Me compared to Encarta reported by schools, expressed as percentages of possible users



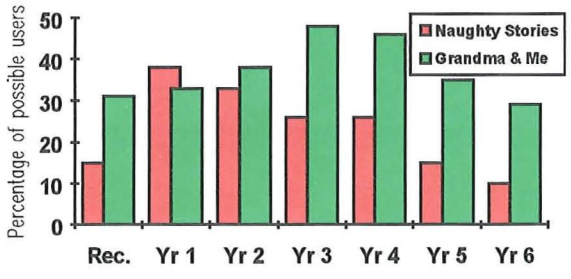
Very few schools had not used at least one of the reading books; where this occurred, it was noticeable that the school commented unfavourably on the American bias of the titles supplied. This would be most apparent in the speech of the characters in the Living Books titles. The researcher's own experience is that this particular series is often, at least initially, more popular with children than teachers. The latter express concerns about the accent and grammatical differences in the text; however, these seem to be overridden when they discover the reaction of children and also the range of activities within the pages, as shown by School B in Chapter 6 in the section, Introducing pupils to CD-ROMs using multimedia reading books. Grandma and Me (MAC and PC) was rated highly and 'used a lot' by 43% of the schools to which it was supplied. Although aimed at KS1, it was reported to be used

by the whole primary age range! Comments were added by schools to the survey forms indicating that they had purchased further titles in this series. MAC systems were also supplied with a Living Book aimed at KS2, The Tortoise and the Hare, which was both highly rated and used by a similar percentage of the potential users.

Unfortunately, these titles were unavailable to Acorn users; instead they were supplied with a CD-ROM version of a number of the Naughty Stories, a British product with clear 'British' speech. Although the animation and text on each pages is much less, they were also very popular with schools; again, although aimed at KS1, they were used across the whole age range. Similarly, schools commented on their purchase of other titles in the series, sometimes as floppy discs which could be used by other classes without a CD-ROM system.

Since no school was provided with both Living Books and Naughty Stories, it was not possible, from this survey, to compare directly these two very different interpretations of the transfer of children's literature to CD-ROM. Fig 4.17 shows the use that was made of these two CD-ROM titles across the primary age range.

Fig 4.17 The use of CD-ROM reading books across the primary age range



Although both titles were used across the whole of the possible age range, the peak of use is lower for Naughty Stories. This could be explained by the reported lack of alternative, age appropriate material for the Archimedes platform or its lack of appeal to older pupils. However, apart from Year 1, Grandma and Me would appear to have been used by a greater percentage of the possible users. Since the user groups were mutually exclusive, with very different choices of CD-ROMs, the researcher feels unable to assess with any accuracy the reasons for this apparent difference in popularity from the survey results alone. Since the launch of the initiative, there has been an upsurge in the commercial production of this type of material which appears

to confirm its popularity. Although Naughty Stories subsequently became available for the PC platform, direct comparison was not possible during the case study either as the materials were still only available on different computer platforms.

As explained earlier in this section, the only title that was supplied to all schools was Creepy Crawlies. Although a third of the schools rated it as 'very good', it was much less used than might be expected from that rating. (Fig 4.14) The reasons for that are not immediately apparent from the survey; however, it may be of note that this CD-ROM is probably most easily linked to the National Curriculum at KS1 but its readability and interest level are more appropriate at KS2.

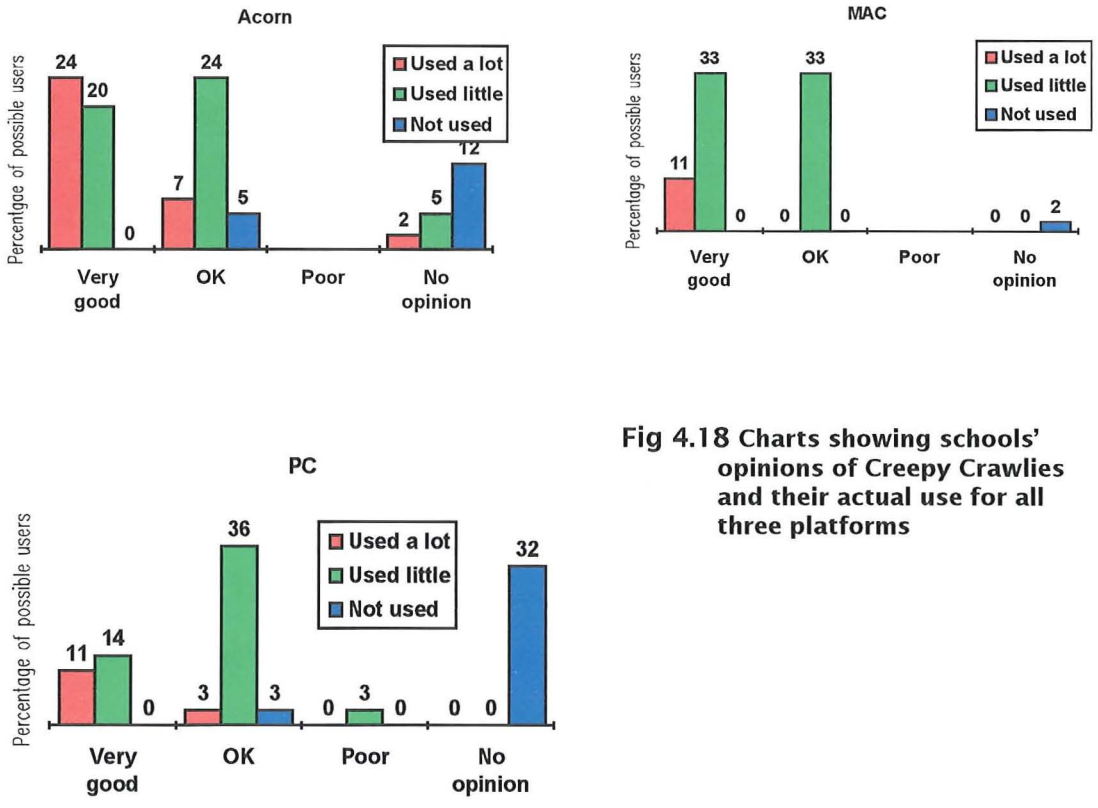
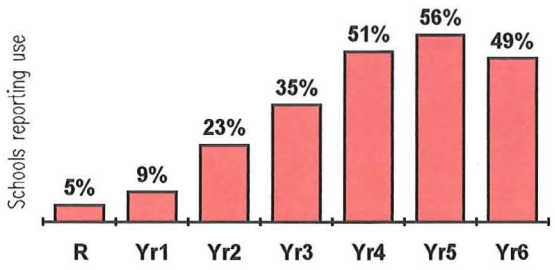


Fig 4.18 Charts showing schools' opinions of Creepy Crawlies and their actual use for all three platforms

Fig 4.19a shows that although Creepy Crawlies was used by schools across the whole primary age range it was considerably more used by years 3 to 6 than younger pupils.

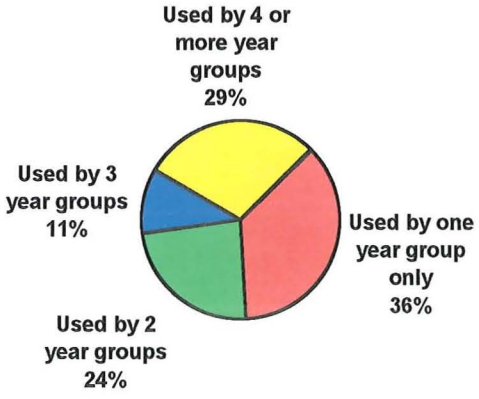
Fig 4.19a The use of Creepy Crawlies across the primary age range



Collins et al. (1996) reported a double peak of use for this title, which they attributed to the availability of two levels of textual information. As can be seen from fig4.19a, this interesting effect was not found by the researcher.

Unlike the reading books, further examination of the data reveals that although use was reported over a wide age range of pupils, this title was frequently used by only one or two year groups in a given school. This could be explained by the use of the title linked to a particular aspect of the curriculum. An alternative explanation might lie in the title and content itself; insects, spiders etc. seem to engender either fascination or horror in adults and children alike. A CD-ROM offering large screen pictures and video on this subject may command a smaller audience than the evaluation team anticipated; the researcher admits that it is not on her list of favourite titles due to content!

Fig 4.19b. The number of year groups using Creepy Crawlies expressed as a percentage of reported users



4.5 Assessment of the multimedia computer system by schools

With very few exceptions, schools felt that the system had proved a very valuable asset to the school; though most added that it had placed additional pressure on staff to learn how to use it. Although a small amount of training, in the use of the system, was provided by the scheme to one member of staff, difficulty seemed to arise with the cascading of that knowledge to other staff. Much depended on the individual school and responses varied from those who bemoaned the fact that use depended on staff confidence (or more likely lack of it!) to those who remarked that 'all staff were very keen'. A remark that occurred several times was that even though **staff** were still learning, the **children** had adapted quickly to the system and were confident users. One respondent was breathtakingly honest and stated that having the machine focused staff on the IT National Curriculum which they were now meeting! This range of responses is very similar to those reported by other evaluators of the Initiative such as Collins et al.(1996) and Sparrowhark(1995).

It was interesting to note that in some schools, the use of the CD-ROM system was confined to perhaps one or two classes (or year groups in small schools). In others, the machine had been placed in a library area with open access to all. In such cases, the validity of the range of use replies could be called into question. Unfortunately, in order to produce a simple questionnaire, detailed questions, that might have clarified this issue, were omitted.

Many schools felt that by the time of the survey, the machine was under-used, often quoting lack of time for staff to both appraise and familiarise themselves with the CD-ROMs. Unlike secondary schools, primary staff generally do not have any non-contact time so such work would have to be undertaken either in directed or their own time. As the former is of limited duration and often absorbed by staff meetings, the researcher would expect the latter to be the norm. Collins et al. (1996) obtained quantitative data on the use of systems over a five day period which revealed a wide range in the level of use of the system between schools. They stated that

> while continuous use is clearly unrealistic.... some schools should look carefully at why the system is being used relatively lightly, to see if there are ways of getting access for more children
>
> Collins et al., 1996:18

From the returns, it was often tempting for the researcher to speculate on the location of the IT co-ordinator within the schools since there was often one particular year group that reported using many more CD-ROM titles than others in the school. From experience in this role, the researcher is aware that the IT co-ordinator's class are often, of necessity, the testing ground for anything new. Fig 4.20 shows the use of CD-ROM titles in two schools. School X indicated on their return that the IT co-ordinator was in year 4.

Fig 4.20 The use of CD-ROM titles in two schools

Title	School X							School Y						
	R	1	2	3	4	5	6	R	1	2	3	4	5	6
Creepy Crawlies					X									X
Information Finder							X							X
Just Grandma & Me	X							X	X	X	X	X	X	X
Mammals					X									X
Art Gallery						X								X
Dinosaurs														X
Musical Instruments					X									X
New Kid on Block														X
Planetary Taxi							X							X
Silly Noisy House								X	X	X				
Sitting on the Farm		X						X	X	X	X	X	X	X
Tortoise and Hare				X	X	X								X
World of Vikings														X

Summary

In conclusion, the researcher felt that despite some shortcomings, the survey had served its purpose in giving an indication, albeit quite superficial, on the way a large number of schools were using CD-ROM technology. The findings were broadly in line with those of other evaluators of the scheme; however some interesting differences were noted. The survey confirmed some findings of the case study, such as the

unsuitability of some large encyclopaedias for primary pupils, and also pointed up some differences, such as the use of printers in classrooms, that required investigation. These findings can be summarised as follows:

For most schools, the CD-ROM system provided by the Initiative was the first, and only, such system in the school. A few recipients already had examples of the technology or were planning to purchase further systems.

Most schools used their CD-ROM system either within classrooms or in a library/resource area with groups of two or three pupils. The large number of schools using both situations implies that, at the time of the survey, schools had not perceived any clear advantage to either situation.

The CD-ROM material was chosen from commercially available software, resulting in a wide difference in the number, and suitability, of CD-ROM titles provided for each platform. Schools found few titles that were suitable for their youngest pupils.

The most popular CD-ROM titles were either multimedia reading books or one large encyclopaedia. These titles met the schools preferences for material that was easy to access, able to be used with a wide age range of pupils and could be linked to the requirements of the National Curriculum. In some ways these were interesting choices; schools commented unfavourably on the American bias of some CD-ROMs, yet these most popular titles were, with one exception, American in origin.

The introduction of this technology was received favourably by most schools but they also expressed the need for more extensive training for staff and opportunities to explore the possibilities of this technology than was provided within the Initiative. It was noticeable that some of the least used, but well regarded, titles were those requiring expertise with the operating system or the use of additional software.

In this chapter, information has been provided concerning the ways that a large number of schools were using CD-ROM technology. Having obtained this broad background of information, in the next two chapters, the focus of the research narrows to examine in detail the ways in which CD-ROM technology was being used by just four schools. Chapter 5 concerns the case study schools themselves, their IT organisation and CD-ROM usage, whilst chapter 6 is devoted to the observations that were made, by the researcher, of pupils using CD-ROM technology in those four schools. Throughout the next two chapters, results from the postal survey will be used to compare and contrast with the findings of the case study.

Chapter 5

The Case Study Schools, their IT organisation and CD-ROM usage

The purpose of the survey was to provide a broad sweep of information on the use of multimedia technology by a large number of schools in two LEAs at one point in time. The detailed case study attempted to look more closely at the way the same technology was being used by four schools, over the period of a year. These four schools were chosen to:-

- be within the area covered by the survey
- be examples of 'good primary practice' - though not necessarily in IT
- have the necessary multimedia hardware/software in use in the school
- cater for pupils with a range of abilities including those with special needs
- reflect the range of experience and expertise found in the survey

This chapter concerns the schools, aspects of their use of IT and aspects of their use of CD-ROM technology in order to address the first research question.i.e.

1. How was CD-ROM technology being used in mainstream primary schools?

a) How and why was the use of CD-ROM technology initiated in the schools?

b) What equipment (hardware and software) was available?

c) How, and by whom, were decisions made concerning purchase and use of equipment?

d) Where and by whom was the technology used?

To answer those questions, the researcher has started from a broad view of the case study schools and gradually focused in, first to their general use of IT and finally at their use of CD-ROM technology, as detailed below. Each of the subsections of 5.2 and 5.3 aimed to elicit information concerning a particular aspect of the research question and this is shown in brackets after each question. The summary to this

chapter brings together those findings under the same headings as the original research question.

5.1 Looks at the background to the four schools including their respective units for pupils with special needs.

5.2 Examines the organisation and use of IT in general within those schools and focuses on :-

What equipment (hardware and software) was available in the schools? (b)

Who was responsible for IT in the schools? (c)

What were the IT Policies of the schools? (all)

5.3 Focuses on the use of one aspect of IT, namely multimedia, within the schools. In particular, it concerns the organisational aspects of the use of this technology and examines:-

How, and why, was the use of multimedia initiated in the schools? (a)

What other hardware did they add to the basic system? (b)

What CD-ROM titles were available in the schools? (b)

How, and by whom, were decisions made concerning purchase of CD-ROM titles? (c)

Where was the multimedia system used? (d)

What were the group dynamics? (d)

5.1 Background to the schools

The case study is based around four mainstream primary schools located within the area covered by the survey. In order to explore the differences, if any, in the uses, advantages and disadvantages of this technology by pupils with special needs, two of the schools chosen included units for hearing impaired children attached to the school; another had set up a 'Booster Unit' for pupils at either end of the ability

spectrum. Pupils from all these units are integrated for at least part of the school day into mainstream classes, although the level of integration depends on the individual child's needs. All four schools have some multimedia equipment provided by a DfE initiative but have a range of experience and expertise in this field. General information on these schools is shown in table 5.1.

5.1a The mainstream schools

School A draws pupils from the main village and surrounding rural area. In the seventies, the original Victorian building became too small to accommodate the expanding school population and new, open-plan premises were built nearby. These comprise a separate LEA Infant school and C of E Aided Junior School. Recently, both schools have decided to seek Grant Maintained status. Although this change might appear as unusual in a national context, locally, most secondary schools and some primary schools are already Grant Maintained. As well as in-class support for pupils with Special Needs, this school operates a Booster Unit where more intensive support is provided both for those with learning difficulties and those of very high ability. One of the reasons for seeking this change of status was to maintain the Booster Unit.

School B is located in an owner-occupied residential area on the outskirts of a town and is a different Local Education Authority (LEA) from the other schools. Although part of a shire county, this town is on the outer fringes of London. The building is modern and semi open-plan; comprising a number of double class bays at different levels on a sloping site. Pupils who have been identified as having special needs are provided with support, mainly within the classroom. There is a part-time special needs teacher and resource room but no separate units within the school.

Table 5.1 Information concerning the four case study schools

School	A	B	C	D
Age Range	Junior C of E Aided	Primary JMI	Junior	Infant/Nursery
Catchment	Large, expanding village with mainline station to London	Privately owned residential area on the outskirts of a London suburb	Mixed residential area on edge of shire county town	Mixed residential area on edge of shire county town
Number of Classes	8	8	12	9 Infant + 2 Nursery
Units	1 SEN	none	1 Hearing Impaired	1 infant + 1 Nursery Hearing Impaired
Classroom type	Open Plan Unit in quiet room	Semi-Open Plan - 2 class bays	2-storey traditional classrooms	single storey traditional classrooms
Number of Computers	15 school 4 unit	17	12 school 3 unit	11 school 3 units
IT co-ordinator	Headteacher until recent change to classteacher	Headteacher	Classteacher for main school 2nd i/c UHI for unit	Classteacher for main school Head of UHI for units
Notes	Headteacher very experienced in IT School is now seeking GM status	Headteacher very experienced in IT 'At leading edge of educational IT' OFSTED	'....scope for improvement in IT' OFSTED	Both IT co-ordinators very experienced in IT.

Schools C and D are adjoining Infant and Junior schools at the edge of a county town. Most pupils are drawn from the surrounding mixed residential areas but the hearing impaired pupils travel in from a wide area of their own LEA as well as some London boroughs. The original buildings, constructed in the sixties, have been extended over the years, but have retained separate classrooms with some shared and open areas. School C has 2 nursery classes; one is for integrated deaf and hearing children and staffed by Teachers of the Deaf. Both Units for Hearing Impaired use Total Communication.

5.1b The units

The Booster Unit in school A was set up and funded by the school itself and occupies the only closed teaching area in the building, originally designated a 'quiet room'. In-class support for pupils with special needs is provided within the school but the unit offers more intensive support and extension for a floating population of pupils whose special educational needs have been assessed to be at stages 3 to 5. Although this support is primarily aimed to develop literacy and numeracy skills for those with a range of learning difficulties, including Dyslexia, the Booster Unit also provides extension activities for pupils with high ability. Thus, it is not perceived by the school population as a 'sink', rather as a privilege. The Teacher in Charge of the unit has been a member of the school staff for some years who makes wide use of IT with her pupils and perceives it to be a powerful resource.

The Units for Hearing Impaired Pupils in both schools C and D are funded by the LEA and are part of a long-standing county provision. Both have a high reputation within deaf education and attract pupils from a very wide area, including some London boroughs. Both use Total Communication, having pupils with a very wide range of impairment and include pupils with cochlea implants. The use of this chosen communication method enables them to meet the needs of pupils who require some sign support to clarify speech to those who use signing only, either Sign-Supported

English or BSL. Pupils are integrated into the mainstream school classes as much as is possible for a given individual. For some years, both Units have used IT widely to help pupils develop language and to access the curriculum. Their work with pupils is included in the NCET publication, Hearing IT. More recently, the Teacher in Charge of the Unit in school D was a course leader for the national GEST funded Hearing Impaired Course organised by NCET.

5.2 Aspects of IT organisation within the schools

As explained in the introduction to this chapter, this section examines the organisation and use of IT in general within those schools and focuses on :

What equipment (hardware and software) was available in the schools?

Who was responsible for IT in the schools?

What were the IT Policies of the schools?

5.2.1 What equipment (hardware and software) was available in the schools?

Although no questions concerning the non-multimedia IT equipment were asked in the survey, the researcher noticed that a number of survey returns commented on the lack of staff confidence and/or experience with the equipment, often to explain the limited use that the IT co-ordinator felt had been made of the system. An explanation of this perceived inexperience could be that previous DfE initiatives to the primary sector, in the 1980s, had been to provide first one system per school, and later to add further systems of the same platform, generally BBC or Nimbus 186. The choice of platform and software used was heavily dependent on the policy of the LEA, since both maintenance of equipment and staff training were generally provided for the LEA 'approved' system only. Although schools may have added computers using the newer platforms, most primary schools and most primary teachers were familiar with either the BBC or Nimbus 186 systems; both of which are very different from those used for CD-ROM technology. When looking in depth at the use that was made of CD-ROM technology in the case study schools, the researcher felt that it might be relevant to examine the whole range of IT equipment in use in the schools and thus place the multimedia equipment within this context.

Most of the schools in the survey reported having only one multimedia system. As shown in table 5.2, at the time of that survey, this situation was mirrored in the case study schools, where only school B had more than one multimedia system.

The platforms use by the four schools are those in common use by British schools and show clearly the effect of LEA policy on systems purchased before the advent of CD-ROM technology. School B is in an LEA which changed its recommended platform for primary schools from BBC to Nimbus 186 and later Nimbus PC. This contrasts with the LEA of schools A, C and D which continued to recommend and support BBC until this was discontinued, then changing to the Acorn platform. However, the introduction of LMS enabled schools greater freedom in the allocation of funds and it will be noticed that school A, with a Headteacher as IT co-ordinator, had started with BBC systems but had later installed a PC network, despite LEA Acorn preference.

Table 5.2 The total IT equipment in the schools

	school A	school B	school C	school D
BBC	3 unit	5	2 in unit	1 in unit
Archimedes no CD ROM	1	0	8	6 + 2 unit
Archimedes with CD ROM	0	0	3	1
Nimbus 186	0	6	0	1
PC (not multimedia)	8 networked 1 portable	2	0	
Multimedia PCs	3 + 2 added	3 + 1 added	1 + 1 unit	1
MAC	0	0	0	1 loan to unit

Table 5.2 shows the total IT equipment in the four schools. The subheadings have been chosen to separate the CD-ROM systems from the rest and also to show if the platform used for multimedia is the same, or different, from that in general use in the school.

Like most British schools, the IT equipment, shown in fig 5.2, has been built up over a period of time, from a range of sources including supermarket vouchers. This results in the use of a mixture of operating systems, which the schools have dealt with in a variety of ways. Due to the differences between funding and use, mainstream classes and units have been separated as follows:

5.2.1a IT equipment in the mainstream classes

Table 5.3 Number of computers and platforms used in the case study schools

	school A	school B	school C	school D
BBC		5		
Archimedes no CD ROM	1		8	6
Archimedes with CD ROM			3	1
Nimbus 186		6		1
PC (not multimedia)	8 networked 1 portable	2		
Multimedia PCs	3 + 2 added	3 + 1 added	1	1
Total no. of computers	**15**	**17**	**12**	**9**
No. of classes	**8**	**8**	**12**	**9**

Average no. of computers available to each class in the four schools

Figure 5.4

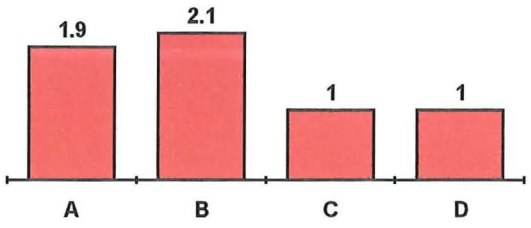


Table 5.3 and figure 5.4 indicate that there is a much higher ratio of computers to classes in schools A and B than in the other two schools. However, the situation is more complex than might be implied from the figures alone and it is necessary to examine how these enhanced provisions were obtained.

In 1983, all primary schools in Britain were provided by the DES with a microcomputer, usually a BBC model B, under the 'Microcomputers in Schools' Scheme. All four schools in the case study obtained BBC model B computers from this scheme. In subsequent years, the government provided funds to the LEAs both to assist schools in the purchase of hardware and software as well as to provide advisory teachers to help schools use those systems. However, the systems available under these schemes were only those recommended by the particular LEA; thus schools A, C and D purchased BBC Masters whereas school B obtained first BBC machines and later, as the LEA recommendation changed, Nimbus computers. As can be seen from table 5.3, only school B is still using its original BBC computers in mainstream classes. This is also due to the very different policy of their LEA from that of schools A, C and D where schools are advised to upgrade all their computers to one modern operating system. When schools purchase new equipment, they are advised to dispose of the older machines. However, using this strategy, it is difficult for schools to afford to increase their total number of computers.

As can be seen from table 5.3, school A predominantly has networked PCs that were installed as a major school investment, some years ago, to provide two networked PCs with shared printer to pupils in each 2-class bay. Subsequent additions have been of stand-alone multimedia PCs, apart from one Archimedes computer, acquired from Tesco vouchers, that is exclusively used for control technology.
The BBC computers were retained but assigned to specific tasks. Currently they are used within the Booster Unit with a wide range of software that is found to address the needs of its pupils ; however, this unit also has a multimedia PC to access the latest appropriate software.

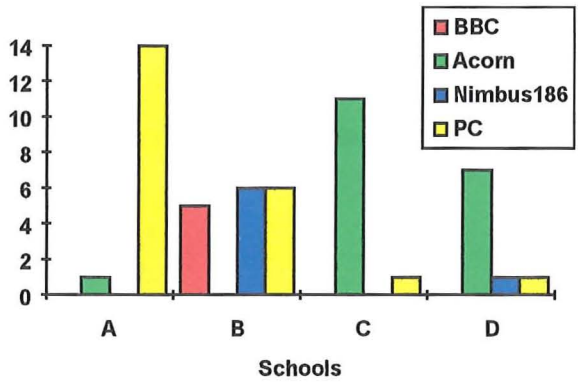


Figure 5.5
The range of computer platforms used in the schools.

As shown in diagram 5.5, school B uses the widest range of computer platforms of all four schools. Although school B has systematically added to its stock, the old machines have been retained. In this way, the school has been able to organise the classroom computers such that there are 2 or 3 computers always available to pupils in each 2- class area. The BBC machines are used by the youngest children; years 3 and 4 use the Nimbus 186 machines and 'progress' to the use of Nimbus PCs in years 5 and 6. Further BBC machines are used for LOGO activities throughout the school. The multimedia machines are located in a central resource area and are available in addition to the classroom provision.

Although the school plans to replace the older classroom machines, it was felt that as they are able to deliver the National Curriculum using these machines, it was more important to supplement the centrally used multimedia equipment first.

Schools C and D appear to be less well resourced. The traditional classroom arrangement makes the sharing of resources more difficult and their larger size of school, reduces the impact of a single DfE funded system. In addition, unlike school B, their LEA policy encourages the replacement, but not retention, of older IT equipment. Although both schools have had a number of BBC systems, these have been disposed of as new systems have arrived. Thus both schools actually have a greater percentage of 'new' equipment than school B although the overall pupil to

computer ratio is higher! As explained in the section concerning IT policy in the schools, although school C has recently purchased only multimedia systems, these are used as ' basic classroom equipment' in order to provide every class with a modern computer, all using the same computer platform.

Through its IT co-ordinator, School D has been able to benefit from LEA reduced price purchasing offers over a period of years to provide each class with a system in line with LEA policy. The NImbus 186 is little used, being the result of a past LEA trial of this operating system. The recently acquired multimedia PC is available in addition to the general provision.

5.2.1b IT equipment within the units

As school B does not have a specialist unit within the school, it is absent from the following table and graph.

Table 5.6 The computers available in the units

	school A	school C	school D
BBC	3	2	1
Archimedes no CD ROM			2
Archimedes with CD ROM			
Nimbus 186			
PC (not multimedia)			
Multimedia PCs	1	1	
MAC	0	0	1 on loan

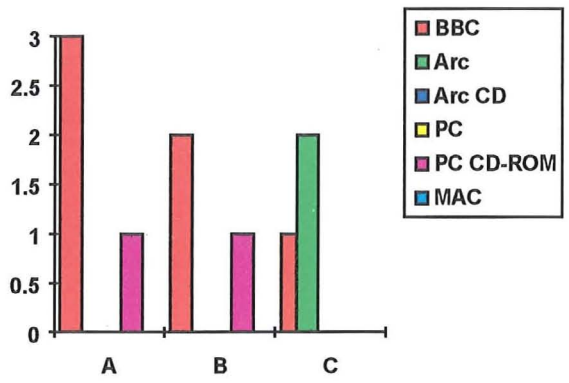


Figure 5.7 The numbers and spread of computer platforms used by the units.

The Booster Unit in school A was developed by the school for its own pupils, many of whom will not be the subject of a Statement of Special Educational Needs (Statemented), and funded by the school itself, rather than the LEA. It is well equipped with hardware and software, using a mixture of old and new equipment. The BBC machines are retained for there is a fund of appropriate materials available that were built up when this system was in use in the school. The children find these machines easy to operate and they provide an excellent pupil/computer ratio. The multimedia machine is able to run the newer generation of software for pupils with special needs. Funds are made available for the purchase of new software. This machine has also been fitted with the video card needed to incorporate home-produced video into children's work. The teacher-in-charge has a bank of materials to assist her in her work and the Booster Unit is a busy and active place.

Before the advent of LMS, the Hearing impaired Units in schools C and D were separately funded by the LEA. Separate funds were provided to school and unit for consumables, plus some capital equipment, and were administered by the Head of each unit. IT equipment was funded from a mixture of sources, LEA, unit funds and charities. When costly items were needed, money from charities and the unit's own funds could be set aside over a period of time to cover the cost. Today, funds are vired from the LEA to the school to cover the running costs of the unit but the way this is allocated lie predominantly with the Head and Governors of the main school who have the needs of the school as a whole to consider. Such units have a high

staff/ pupil ratio and an apparently good level of IT provision, albeit rather elderly! In times when money is scarce, the unit therefore becomes squeezed between the requirement of the school to meet the needs of all of its pupils and the inability of the LEA to provide additional funding. Units are also unable to benefit directly from DfEE schemes which are aimed at either special or mainstream schools. Applications to either source rarely meet with success; in part this is because the number of pupils is small and they do not fit easily into either category.

Although both units obtained BBC model B computers soon after microcomputers were introduced into schools., additions have proved difficult to fund. As part of an individual pupil's special provision, the unit in school C obtained a BBC Master system from the LEA. This reverted to general unit use after the pupil had left. However, although the main school has gradually replaced its BBC systems with Archimedes, the unit had not been able to fund such a change. They recently obtained the multimedia system from an LEA SEN initiative but this was to enable the subtitling of video materials plus administration of the statementing procedures!

The unit in school D has always made considerable use of IT. The Head of Unit's conviction of the value of IT was responsible for the addition of two Archimedes computers by a mixture of charity and LEA funding. The three machines are now shared between the infant and nursery units and are in constant use. Although hardware additions such as a touch screen have been possible, none of the attempts to replace an entire computer system have proved successful. e.g. unlike school C, their application for a multimedia system under the LEA SEN initiative was not successful. The system used by this unit for the research was provided on short term loan. If it proved successful, then funds would be sought to purchase a system.

5.2.2 *Who was responsible for IT in the schools?*

5.2.2a Responsibility for IT in the mainstream classes

As can be seen from table 5.1, responsibility for IT has rested for some years with the respective Headteachers in schools A and B. Both are confident and competent users of IT themselves and perceive it as an important curriculum area that requires continuing funding and forward planning.

The Headteacher of School A has been in post for many years and has been responsible for IT since the introduction of microcomputers into schools. He was a member of the County Leaders in IT Panel, who were selected by the LEA IT Advisors for their expertise in this aspect of the curriculum. County Leaders frequently trialled software and hardware for the LEA as well as providing training and advise to schools in the county on behalf of that LEA. When changes in the organisation of the LEA and their Advisory Services led to the disbanding of the County IT Panels and Leaders groups, he ensured that the use of IT remained a high priority in the school. The replacement of hardware and software have always been included in the financial planning which enabled the school to access the latest technology. However, during the period of the research, the responsibility for IT has been transferred to a member of the teaching staff, as shown in diagram 5.1. A recently completed OFSTED inspection states, in section 148, that:

> Standards of attainment (in IT) are well above national expectations at the end of the key stage. Pupils have many opportunities to systematically acquire knowledge, understanding and skills in all aspects of the subject so that by the end of the key stage many pupils use computers competently and confidently.

The Headteacher of school B has been a member of staff of the school for most of her teaching career. Unusually, she has been promoted several times within the school, first to Deputy Head and latterly Headteacher but throughout has retained her responsibility for IT development. The school benefits from close links with the county IT team as well as more recent links with NCET. OFSTED Inspection Report 919/2429 states that the school is

> at the leading edge of educational information technology and standards in that respect are exceptionally good. The curriculum is broad and balanced and the use of IT across subjects is well developed. The planning and work are guided by a good policy and scheme of work. The high quality of the co-ordination is a key factor in the achievements of teachers and pupils alike. There is an excellent range of good quality resources which are well located and organised.

In schools C and D, neither Headteacher has a particular expertise in IT and the responsibility for this area of the curriculum is with members of the teaching staff.

The IT co-ordinator in school D has been in post for a number of years. She was a member of the County Leaders Panel and, like the Headteacher of school A, was involved in the trialling of equipment and delivery of INSET for the LEA; she still maintains links with the current IT advisory team.

Although the IT co-ordinator in school C has received some additional training in the subject from the county advisory team, she does not have the depth of knowledge or seniority within the school of the other co-ordinators. IT does not have the same priority within the school as schools A or B and the co-ordinator was aware that some staff were not exploiting its potential within their classrooms. This view was confirmed by a recent OFSTED inspection which considered the teaching of literacy and numeracy in the school to be 'very good' but stated that 'there was scope for improvement in the area of educational information technology'.

5.2.2b Responsibility for IT within the units

Although the IT co-ordinators of each school are responsible for the use of IT and delivery of the IT National Curriculum within the units, there are additional,and specialised, uses of IT which are the responsibility of the unit staff. In schools A and D, the Heads of Unit have taken on this responsibility, having particular expertise and interest in the subject. e.g. the Head of the Hearing Impaired Unit in school D has a nationally recognised expertise in the use of IT with hearing impaired children and has contributed to NCET publications and courses. Uses made of IT within the unit

have been influential on the main school. Table 5.8 shows the way in which IT is used in the main school and unit of school D. As can be seen from this table, the unit children use IT in many ways that are not included in the National Curriculum. Some uses are specifically aimed at the pupils' impairment, such as the use of IT to develop voice development. They start to use IT for curriculum-based activities at an earlier stage of development than the mainstream classes and the structured tasks provide smaller steps of progression than in the main school. These additional uses of IT are the responsibility of the Head of Unit.

Another noticeable feature is that the basic software used in the mainstream classes and unit is not the same. The software in the mainstream classes is that recommended by the LEA. Although the unit has access to this software, alternative software is used if it better meets the needs of the pupils. e.g. The graphics program used in the unit offers the additional facility to create slide shows very easily. This enables pupils to tell a story by creating a sequence of pictures with, or without, captions and can be used by pupils at an earlier level of literacy development than a wordprocessor. This provides an example of the way in which basic software is used within the unit for additional curriculum uses to those of the mainstream classes and sometimes requires the use of alternative software.

Table 5.8 The uses of IT within school D

Use of IT	School	Unit
Making friends with the computer		Range of simple activities on BBC and Arc to learn - cause/ effect - use of Touch screen, - - concept keyboard and standard keyboard - to develop mouse control
Development of language		creation of slide shows in Flare to tell/ sequence a story specialist BBC software with concept keyboard linked to reading scheme assemble scene using structured sentence from concept keyboard
Communicating and handling information	simple wordprocessing using Pendown picture creation with art package -Splosh data work using Junior Pinpoint	use of Phases for - to create class newspaper - simple wordprocessing pictures created in Flare for use in newspaper simple bar charts in Graphplot simple data work from concept keyboard
Controlling, measuring and modeling	assemble a scene using My World control of screen turtle - First LOGO	assemble a scene using My World control of floor turtle with - voice. - concept keyboard, control of screen turtle from concept keyboard Ist LOGO
Development of voice		use of micromike to learn -cause/ effect using voice - develop range of sounds

5.2.3 *What were the IT policies of the schools?*

Schools A and B formulated IT policies some years ago. However, as can be seen from table 5.1. the Headteacher of both schools was also the IT co-ordinator. It was their responsibility to ensure that the school had policy documents for all subjects, including IT. Southwordth (1993) considered that the value-shaping leader operated at two levels; a higher level of abstraction and definition of beliefs as well as a more detailed level.Thus, operating at that higher level, with their dual roles of Headteacher and IT co-ordinator, the researcher considered it unsurprising that the IT policies were among the first to be written in their schools and that these policies have been modified with changes to the National Curriculum as well as changes in the equipment available to deliver that curriculum.

School B places emphasis on four strands - word-processing, graphics, information handling and LOGO. This last strand is retained although it now has less prominence in the post-Dearing National Curriculum since it is considered useful for the development of logical thinking. This is a reflection of the school general policy where self-discipline and reliance are encouraged and emphasis is placed on the development of independent study skills. Funds are made available for the acquisition of new software that may assist in the delivery of the curriculum. As can be seen from appendix 5, the topic folders include information for staff of materials available for that area.

School A has a similar ethos but its It policy more closely follows the National Curriculum. The network provides pupils with the facilities to access the areas of IT identified in that curriculum and in addition, software is purchased to enhance the delivery of that curriculum. Staff are provided with a list of software packages available in the school, updated as necessary, with suggestions as to use and age group suitability.

Although school C has a written IT policy, the IT co-ordinator was aware that this was not fully implemented in all areas of the school. Recent purchases mean that every classroom now has its own modern system and staff no longer have to share computers. She felt that the highlighting of this weakness in the school's recent OFSTED report was helpful to her aims, since it alerted staff to this area of the curriculum and the need for IT to become intrinsic to the delivery of the curriculum.

The school had received a CD-ROM system under the 1994/5 DfE scheme but she felt that the potential of multimedia had not been fully realised by staff in the past. She considered that this was because they had chosen an Acorn system, since this was the operating system in use in the school. However, as was found in the survey, the choice of CDs was more restricted than the other two platforms and their reception by schools was generally less favorable. In practice, this CD-ROM system was used as a standard Acorn system. Russell (1995, 1988) argues that technology will only be used successfully in a classroom when an individual teacher identifies a relevant application. Since staff in school C had not found any of the CD-ROM applications relevant to them, the technology had not been assimilated into the curriculum. Maddux (1993) discusses instances such as this and suggests that

> nothing miraculous happens automatically as a result of putting a child and a computer in the same room.
>
> (Maddux, 1993:16)

The recent acquisition of the multimedia PC, combined with pupils and staff having similar systems at home, had resulted in more enthusiasm for the use of multimedia.

However, the IT co-ordinator considered that her first priority was to ensure the delivery of the of the IT strands of the National Curriculum throughout the school, so her recent purchases had been of Acorn 'non-CD-ROM' machines. Now, apart from herself, every member of staff was using the same operating system and always had access to that system. INSET could be provided to staff on specific applications that all staff should be able to implement with their pupils. The OFSTED report had made

all staff aware of the need for improvement in the use of IT and she was hopeful of greater success in this area in the future. In this way, she hoped to move the school from stage 1 to stage 2 of Maddux' three stages of educational computing. Maddux (1993) proposed three stages of educational computing:

Stage 1 - educational computing is based on the idea that exposure to computers produces general educational benefits (p14)

Stage 2- the rationale is that whilst stage one assumptions may not be true, exposure to particular applications would produce educational gains (p16)

Stage 3 - concentration is changed to a concentration on learner/treatment interactions (p19)

In his discussion of stage two philosophy, he states that

> ..efficacy (of education computing applications) depends on how they are used rather than on their mere presence or absence in schools.
> (Maddux , 1993:16)

It will be interesting to see how, and if, the provision of this new equipment enables the school to become better users of IT and whether its use becomes embedded in the delivery of the curriculum. The situation in school B would imply that the use of modern equipment is not necessary for excellence in the use of IT; however, the OFSTED report has raised the importance of IT and the need for perceived improvement, with senior management in school C. It will be interesting to see whether this combination of new equipment, INSET and a higher importance within the school effects the anticipated changes.

School D has also had an IT policy for some years but the requirements of Key Stage 1 are less exacting than at other stages. The choice of software in the school is strongly influenced by LEA policy, which is restricted to a quite limited list of "approved software'. Although these packages are educationally sound, being content -free and usable over a wide age range, they may not be most effective at Key Stage 1 e.g. Junior Pinpoint for data handing.

The Head of the Unit in this school has a national reputation for the use of IT with her pupils. Here, the use of IT is rather wider than the IT strands of the National Curriculum for it includes the development of vocalization, language and re-presentation of ideas in more pictorial than linguistic form, as well as the practising of skills.

5.3 Aspects of CD-ROM usage

This section focuses on the use of multimedia, within the schools. In particular, it concerns the organisational aspects of the use of this technology and examines:-

How, and why, was the use of multimedia initiated in the schools?

What other hardware did they add to the basic system?

What CD-ROM titles were available in the schools?

How, and by whom, were decisions made concerning purchase of CD-ROM titles?

Where was the multimedia system used?

What were the group dynamics?

5.3.1 How and why, was the use of multimedia initiated in the schools?

Although all four schools had been recipients of CD-ROM equipment under a DfE initiate, this input of 'free' equipment had come at various stages of their development of this work.

As early as 1993, school B had perceived the potential of this technology and had purchased their first multimedia system using funds raised by parents. This funding was in part responsible for their decision to site the machine in a central area where it could be both seen and accessed by as many children as possible. With encouragement from an institute of higher education, school A had upgraded a 'spare' PC to use this technology. With school A they subsequently took part in a short study of the use of CD-ROM in Primary schools with that institution.

The success of this work encouraged both to apply for systems under DfE schemes; school A received a system in 1995 whereas school B was successful in both 1994 and 1995. A fourth system was given to School B by their LEA as part of an Internet trial. However, effective use of the Internet required greater adult input and took longer than expected, so during much of the period of the research, this was primarily used as an additional CD-ROM system.

Table 5.9 The case study schools' acquisitions of multimedia systems

	A	B	C	D
1993		system purchased by parents		
1994	upgrade of 'spare' system	DfE system	DfE system	
1995	DfE system 1 system purchased	DfE system LEA system		
1996	2 systems purchased		LEA assisted systems to school and unit	LEA assisted system to school

It may be relevant that in both schools, the IT co-ordinator was also the Headteacher when these decisions were made. They are non-teaching heads and although neither would be able to regularly timetable themselves to work with the multimedia systems, they are not in the same position as a full time class teacher.However, in both schools C and D, the IT co-ordinators are full time class teachers.

School C received an Acorn system under the 1994 DfE initiative. However, as explained in the previous paragraph, this was perhaps the wrong machine at the wrong time in the school's development. The one day of training provided for a member of staff under this scheme was insufficient to appreciate the potential of this technology, acquire the practical skills of using the system sufficiently to cascade this to others in the school. Of all the methods of dissemination, cascade is often the preferred method, as discussed by Schon (1973). Russell (1995) contends, this method has been 'hugely unsuccessful'. He considers that

> an IT application will only be used successfully in the classroom when an individual teacher identifies a relevant application.
> (Russell, 1985:3)

It is certainly true that none of the applications provided with the Acorn CD-ROM system were identified as 'useful' by the staff of this school.

Only with the arrival, some two years later, of the multimedia PCs in both the unit and main school has this technology to taken off in the school. Several members of staff as well as pupils, have similar machines at home and were already familiar with the technology. Although the machines came with a range of CD-ROMs, some of the titles actually in use came from home, or had been first seen and experienced in that context. Staff had identified the relevance of an application and were indeed using it.

School D had obtained its system under an LEA scheme linked to DfE funding. this provided a similar multimedia PC to the NCET system but the software supplied was less extensive and mainly aimed at Key Stage 2 and above; no further software had been purchased. The IT co-ordinator was seeking advice on possible future purchases and observations of pupils was made mainly using software provided by a parent helper. The school's previous experience of the use of only LEA recommended content- free, open-ended software meant the IT co-ordinator did not have background knowledge of a range of software houses, their relative merits or indeed alternative sources of advice.

Table 5.10 The four schools' introduction to multimedia and its results

school	CD-ROM introduced	How obtained	What system	Result
school A	1994	upgrade of stand alone	PC	DfE system + 3 purchased
school B	1993/4	PTA purchase	PC	1994 printer +video added 3 systems obtained
school C	a) 1994 b) 1996	DfE purchase - main school LEA - unit	Acorn PC	CD-ROM little used CD-ROM used
school D	a)1995 b) 1996	loan to unit LEA assisted purchase	MAC PC	used some use

5.3.2 What other hardware did they add to the basic system?

Although the DfE initiatives provided schools with a multimedia computer and a range of CD-ROMs, it did not provide a printer. As shown in the survey, schools approached this potential problem in a variety of ways, which also affected the subsequent use of the CD-ROMs. When schools A and B obtained their first CD-ROM systems, they rapidly identified the need for additional equipment as reported by McDevitt (1994).

The system that was upgraded by school A was already sited on a small trolley. However it was found that this could not easily accommodate the additional hardware required. As the system was operated in the class areas, headphones were required in addition to the speakers. The need for a printer was identified and at first a spare

dot matrix was used. However, this proved intrusive in the classroom and as soon as funds allowed, a colour printer was added. As further systems have been added, colour printing facilities have been provided from the outset. The system that is used in the Booster Unit also has a video card added to enable incorporation of home produced pictures into the children's work.

School B had placed their system on a standard BBC trolley and added a colour printer plus video card to enable the production of multimedia stories, as shown in table 4b9. Subsequent acquisitions were automatically provided with both trolley and printer.

At the start of this case study, both schools A and B had provided colour inkjet printers with their systems and purchased printers as a matter of course with subsequent additions. Although little used as yet, they both had a video card added to one system to enable the importation of video into their own multimedia. School B had entered the NEMA competition in both 1995 and 1996, whilst school A plan to introduce the production of multimedia into the upper juniors in the Autumn Term of 1996. Both schools recognise the need for continuous upgrading of software and additions of hardware to their IT equipment and provide for this within the school budget and/or fund-raising plans.

In 1994, School C had used the DfE CD-ROM system to replace a class BBC computer but retained the existing printer and trolley. When the multimedia PC had been recently purchased, the colour printer recommended by the LEA had been purchased at the same time. No further hardware additions were planned for the near future.

As their unit CD-ROM system was partly provided for staff administration, a colour printer had been provided with the system and placed on an existing trolley; the previous occupant, a BBC B system, being moved to a table. It was hoped that the video subtitling equipment might be provided in the future.

The LEA-assisted purchase by school D had included printer and trolley. No further hardware had been found necessary.

The MAC system in the unit to school D was on loan from another institution in order to assess the effectiveness of the technology in meeting the needs of the children. Unlike school B, the existence of fairly modern equipment in the unit appeared to mitigate against them obtaining a system from their LEA or DfE schemes.
Although only a few years old, it was found that the reduced RAM and screen size of this loan system, compared to more modern machines, greatly restricted the range of CD-ROMs that could be used. This graphically illustrated the need for updating even apparently sophisticated hardware.

A colour printer was provided on loan by the researcher as it was anticipated that screens would be printed out. In practice, the printer was not used for this purpose as the CDs that could be run on the system did not offer this facility and it was mainly used for children's word-processing and graphics. Again, the system was placed on an existing trolley.

In the survey, the lack of a printer was felt by many schools to be a considerable restriction on the use that they could make of the CD-ROM titles provided. Although the schools in the case study were all able to provide printers, they still found themselves restricted by other factors, as shown in table 5.11 :-

Table 5.11 Problems found in the use of CD-ROMs by the case study schools

	Restrictions on use of CD-ROMs	Solution tried
School A	Noise of printer Intrusive nature of sound effects, speech etc. -	purchase of inkjet printer headphones provided
School B	Quality of printouts Ease of availability of printouts	Both were due to restrictions within the CDs rather than hardware and have both been reduced by newer generation of CD-ROMs
School C (DfE system 1994)	Relevance of material provided Availability of alternative, and relevant, material	Neither were resolved until the recent acquisition of alternative platform with wider range of material
School D **(Unit)**	Suitability of material provided Lack of confidence/ information on more suitable purchases. Hardware not sufficiently powerful to run most of the CD-ROMs available.	IT co-ordinator provided with information to help her have confidence to make her own decisions! Loan system could not be upgraded

As can be seen from table 5.11, some of the problems were solvable, often by the provision of additional or alternative hardware, whist others were more intractable. As reported in the survey, school B were dissatisfied with the quality of the printouts they produced, even with the latest colour printer. However, they perceived that the technology offered sufficient advantages to continue with its use, despite this problem, and the children's tasks were changed so they no longer required more

than occasional use of the printer. They also experimented with their own multimedia publishing, where traditional hard copy was not needed.

Although the later generation of CD titles has made the printing of whole screens and pictures very much easier, it can still be complex for young children to attempt to print out individual sentences, phrases etc. It has become accepted practice within both Schools A and B for pupils to collect such information by handwriting into notebooks; the printer being reserved for pictures and whole screens that are used as part of individual or class Topic work.

The limited range of titles available in school D can be expected to be temporary since the IT co-ordinator is experienced both as a teacher and in the educational uses of IT; she also has money available to spend on new material. Had the system in the corresponding unit belonged to the school, then funds would undoubtedly have been found to upgrade it to run a greater range of titles, for staff and pupils were convinced of the usefulness of the technology. The experience with this machine had shown staff the need to overestimate requirements when purchasing any new computer system of their own.

The difficulties experienced by school C and shown in table 5.11 were also expressed by schools with Acorn systems who responded to the postal survey. Unfortunately the production of CD-ROM titles is very expensive and requires either a world market or some form of subsidy to be financially viable. With neither available to the Acorn platform, the range of titles has continued to be highly restricted. Had school C been more experienced users of IT, it is possible that they would have been able to make better use of the picture bank CD-ROMs provided. However, the initiative only provided for limited initial training in the use of the technology. It may have been assumed by the training organisations that schools would both have the appropriate software and, more importantly, the knowledge of their use, to incorporate the pictures from the CD-ROMs into other applications. However, like many of the other

schools surveyed, school C were unable to do more than view small pictures on screen. In reviewing the initiative, it was possible for Sparrowhawk and Heald (1995) to identify this problem but by then, it was too late since no funds were available for further training to remedy the situation.

5.3.3 What CD-ROM titles were available in the schools?

Each of the DfE initiatives included, with the multimedia computer, a number of CD-ROM titles. These were chosen by NCET to be of high quality and to give recipients experience of different types of CD-ROMs such as encyclopaedias, reading books, subject specific information etc. that might appeal to a range of ages within the primary grouping. In addition, many suppliers of multimedia systems offer a bundle of CD-ROMs with the machine. All four schools had benefited from this to some extent - although in the case of school C, the titles provided in the DfE initiative had not proved sufficiently motivating to encourage further exploration of the technology. This view of the Acorn titles was echoed by many schools taking part in the survey who remarked upon the paucity of CD-ROMs for this system, either provided by the initiative, as shown in fig.4.11b, or available for purchase.

As shown in table 5.12, by far the greatest number of titles were available in school B. With each machine, they had acquired a number of free titles, to which the school had added further purchased titles. In addition, parents had taken part in a publisher's consumer research project which had resulted in the presentation by the publisher of a number of their products to the school stock. Although staff might not have chosen these titles independently, like most teachers they had found ways to use this material to advantage. As shown in appendix 5, titles of suitable CDs were included in the Topic information sheets provide to help staff in the delivery of the National Curriculum. Recent purchases had been of titles to meet Topic needs as well as of multimedia reading books for the younger pupils.

Table 5.12 The range of CD-ROM titles available in the schools

school A	school B	school C	school D
A-Zap	Anglo Saxons		Anglo Saxons
	Bodyworks 3		
Broderbund:-	**Broderbund:-**		
Little Monster in School	Just Grandma and Me		
Arthur's Teacher Trouble	Arthur's Birthday	*Arthur's Birthday Party*	
Arthur's Birthday	Harry and the		
Tortoise and Hare	Haunted House		
Maths Workshop (unit)	Tortoise and Hare		
	New Kid on the block	*New Kid on Block (loan)*	
Guide to Classical Music	Busy Town		
	Creepy Crawlies		
Dorling Kindesley:-	**Dorling Kindersley:-**		
Ultimate Human Body	Ultimate Human Body		
	Encyclopaedia Of Nature		
	Encyclopaedia of Science		
The Way Things Work	The Way Things Work		
First Amazing Dictionary	First Amazing Dictionary	*First Amazing Dictionary*	
Exploring Earth Sciences	Hyperstudio		
Flying Colours	Kid Pix		
Hutchinson Encyclopaedia			
Information Finder	Information Finder		
Kingfisher Children's	Jumpstart First Games		
Encyclopaedia	Jumpstart Pre-school	*Maths Ace*	
	Mammals		
Ms Ancient Lands	Ms Ancient Lands	Ms Ancient Lands + *unit*	
Ms Art Gallery	Ms Art Gallery		
	Ms Encarta 94 and 96	*Ms Encarta 96*	
	Ms Oceans		
Ms Dangerous Creatures	Ms Dangerous Creatures		
Ms Musical Instruments	Ms Musical Instruments		
	Multimedia Flash Cards		
	MM Box		
	Music Explorer		
	My First Encyclopaedia		
	NEMA Awards CD		
	Photo CD		
Rabbits at Home	Rabbits at Home		
Speaking Starspell (unit)	Random House - Kids		
Vikings	Encyclopaedia		
York			

School A had also obtained titles with the systems provided by the DfE or supplier. In addition, further titles had been purchased. Although CD-ROM titles were not included as yet within topic information folders in school A, staff were provided with lists of titles with suggestion for age range, topic use etc. These had been compiled by the head teacher in his role as IT co-ordinator at the start of the case study but were being updated by the member of staff who took over this role during the year.

Schools C and D had acquired their machines more recently. As the system in school C was also a class computer and needed for other purposes, time had only permitted the use of the encyclopaedia provided with the system and a topic specific title - provide from home by the class teacher. As this had proved successful, it was hoped to purchase this when funds permitted. Whilst the multimedia system was doubling as a class computer, there was no priority to add further CD-ROM titles. The IT co-ordinator felt that her priority was to ensure that all staff delivered the strands of the basic IT National Curriculum, using the software already within the school, as suggested by the OFSTED report. Once this had been achieved, then the wider use of multimedia could be initiated, which would require the acquisition of another system either to provide her with a class machine or the school a multimedia system.

The system in the unit of school C had also arrived with a bundle of very similar CD-ROM titles that were designed for general primary use. Staff had reviewed these titles but felt some to be inappropriate in this situation. e.g. too dependent on sound effects or involving complex use of language without pictorial explanations. However, with adult help, use was made of some software such as Encarta, mainly for the pictures and videos. Several staff in the unit had similar systems at home and use was often made of CD-ROMs brought from home such as Ancient Lands which was used with a Topic on Ancient Egypt by the unit and subsequently by children in the main school! Through 'family interest', some members of staff regularly visited local PC shops where new titles were on display enabling them to assess their suitability and initiate a request for purchase.

The pattern of use of CD-ROM titles in these three schools was very similar to that reported by the schools surveyed. The use of reading books predominated with the younger children whilst the older pupils used both general encyclopaedias and other subject specific material that staff had identified as helpful in the delivery of the National Curriculum. It was interesting that this latter material was often produced by either Microsoft or Dorling Kindersley. Although often visually stunning, it was published for a world home/leisure market rather than for the British National Curriculum and as can be seen in Chapter 6 section 6.4, this could create problems when used with young children in an educational context.

The titles provided with the system to the main school of school D were felt unsuitable for Key Stage 1. This was a fault reported by infant schools who responded to the survey. As the machine was located in an open area, a parent helper had been recruited to supervise the children's use of the system. She had a similar system at home and brought titles from home to use with the children. The titles used would perhaps not have been chosen by the IT co-ordinator but were used as a temporary solution to the problem. Although an experienced user of the Acorn system for more traditional applications, the IT co-ordinator did not have experience of this type of technology, neither did other members of the main school staff. LEA policy on the use of a very limited range of 'recommended' content free software, although helpful to the delivery of the IT strands of the National Curriculum, was not applicable to this situation. Further, the school was not accustomed to the purchase of software since most had been provided with the computers under LEA schemes as appropriate for this age range. Although extra screen sets had been purchased for applications such as My World, the cost of such sets were much less than that of most CD-ROM titles. In this case, the 'provided' software was found to be inappropriate and perhaps for the first time, teachers were required to search out suitable material for themselves since in this ever-changing market, an LEA recommended list is not possible.

Although the system in the unit was only on loan, in theory, the unit had access to a wide range of titles, including those recommended by NCET in the later CD-ROM initiatives. However, in practice, this was restricted to those titles that would operate on the machine they had been loaned.

5.3.4 How, and by whom, were decisions made concerning purchase of CD-ROM titles?

Many of the CD-ROM titles that were available in all four schools were not of their choosing; having been provided with the system, or, as in the case of school B, donated by a publisher. These CD-ROMs were used when they fitted the needs of the school but some of the schools had purchased additional titles from their own funds. The table below summarises the way these purchases were decided.

Table 5.13 How CD-ROM titles were chosen by the schools

School	Suggestions to purchase/ use	Decision maker
A	Staff visit to BETT plus list to staff Personal recommendation by staff/ pupils	Head
Unit A	as above plus county SEN exhibition by unit teacher	unit teacher + Head
B	Lea Advisor NCET personal recommendation by Head and staff	Head
C	No purchase plans	Head
Unit C	Staff + researcher recommendation	Head of Unit
D	IT co-ordinator	IT co-ordinator
Unit D	Head of Unit + researcher recommendations NCET	Head of Unit

School A

Some titles for purchase were chosen by personal recommendation whilst other had been after a staff visit to the BETT exhibition, followed by lists circulated to staff of titles that it was thought might prove helpful. These were mainly in the delivery of the curriculum, The teacher in charge of the Booster Unit had also attended a county Special Needs exhibition where she had seen specialist CD-ROM materials which were subsequently purchased. Decisions over titles purchased ultimately rested with the Headteacher but staff were both consulted and able to initiate requests for new titles. The need for continuing purchase of software and hardware was accepted within the school and funds allocated for this purpose.

School B

Purchasing decisions were ultimately made by the Headteacher on advice from her LEA advisor, contact with NCET, as well as her own and her staff's experience. The researcher's views were sought on titles for purchase etc. As in school A, the need for continuing purchase of software and hardware was accepted within the school and funds were set aside for this purpose.

School C

Purchasing decisions were normally made by the IT co-ordinator within a budget agreed with the Headteacher. However, there were no immediate plans for the purchase of additional CD-ROMs since the system was used as a class computer and there were no funds available for this purpose.

However, within the unit, the potential of this medium to enable their pupils to access the National Curriculum in a more meaningful manner was appreciated by the whole staff and titles were purchased within the limits of the funds available; sometimes this was initially by a member of staff for subsequent purchase by the unit, if it proved successful. The decision to purchase, or not, was made by the Head of Unit in consultation with unit staff.

School D

Decisions concerning purchase of titles were made by the IT co-ordinator who felt ill-equipped to deal with a situation where she had total freedom to chose, within an agreed budget. She was aware that there was a vast range of titles available but also that she had no previous experience of age-appropriate commercial software, either good or bad, and an awareness that mistakes could prove expensive, particularly in comparison with previous purchases. She was also unaccustomed to the rapidly changing nature of the CD-ROM market and the likely need for on-going upgrade and/ or change of hardware and software. The result was that no titles had actually been purchased by the end of the academic year.

The teacher in charge of the unit was perhaps in a better position to make purchasing decisions, than her mainstream colleague, having needed to extend her use of IT beyond that of the National Curriculum IT strands and the consequent LEA recommendations. In addition, she had a multimedia system at home and experience of other titles through NCET contacts. Originally, it had been hoped that as a result of the multimedia trial, the unit might obtain their own system. However, the decision by the teacher in charge to retire at the end of the year led to the postponement of that proposal.

Southworth (1993) considered that leadership was about infecting one's colleagues with one's own educational beliefs. As shown in this section, the schools with both the greatest number of titles and also on-going purchasing plans were those where the technology was perceived to be of high value by the Headteacher (or their equivalent in the units). Watson et al, (1993) considered the role of the Headteacher as an influencer and, based on their findings, Brown and Howlett (1994) stated that

> The attitude of the headteacher is the most important factor in influencing attitudes towards computers and information technology in the school. Only if this is positive will it be reflected in a positive attitude in the other teachers and pupils.
> (Brown and Howlett, 1994:26)

Whilst operating at Southworth's higher level (Southworth, 1993), in the setting of IT policies for their schools, the headteachers of schools A and B were also operating at the more detailed level to make funds available for on-going purchasing. Not only did they perceive a need for software but also for hardware upgrades and training. Ironically, the positive approach and willingness to invest, enabled school B to obtain much free hardware and software!

Although senior managers might finance the purchase of the CD-ROMs, and have the ultimate decision on which to purchase, the views of class teachers was actively sought and respected in all the schools. Since there are few titles being developed specifically for education, the most successful purchasing occurred where there was a dynamic relationship between those using the CD-ROMs and those with financial control. There was also an acceptance that mistakes would inevitably be made and some CD titles would not live up to expectations or only have a limited use. Choices tended to be made either from past experience of similar titles from the same software house, or personal (often home) experience of a particular title. This was particularly apparent in both the survey schools and the case study where favourable experience with one Living Book title encouraged schools to seek out and purchase new titles as they appeared.

Where funding was more restricted, expectations from any individual purchase was higher and a mistake could easily prove disastrous. Responsibility for purchase was placed by the Headteacher in the hands of their IT co-ordinator who then had the invidious task of choosing title(s) in the absence of either personal experience of same or availability of unbiased advice. In school C, where the implementation of the strands of the IT National Curriculum was of primary importance, the technology was being operated using applications provided from home by staff. As CD-ROM technology was abandoned in the past due to non-availability of relevant material, the researcher hopes that this will not recur due, this time, to lack of investment.

5.3.5 Where was the multimedia system used?

As can be seen from fig 5.14, it was found from the survey returns that most schools placed their first CD-ROM system either in a central resource area or in an individual classroom, often that of the IT co-ordinator. Within such a limited survey, it was not possible to discover the reasons for that decision.

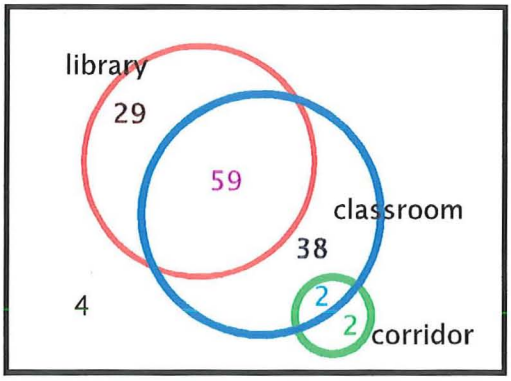


Figure 5.14 The locations of the multimedia systems reported by the survey

Fortunately, this same pattern was found in the case study schools, where the reasons for the choice of location was able to be investigated and may be indicative of those of at least some of the survey schools. Table 5.15 shows the siting of the CD-ROM systems in the four schools. As an aid to clarity, this section has been divided into subsections based on location of system rather than individual school.

5.3.5a Systems used in a central resource area

When school B obtained their first multimedia PC, it had been purchased for the school by the PTA. The Headteacher and her staff felt it important that as many children as possible had access to that machine, at least initially. Unfortunately the sloping site and consequent steps in the school make the transport of the system very difficult. Instead, it was decided to place the new system in a central area where parents could see it being used as they entered the school, and set up a timetable so every child was allocated access to the machine. As further systems were added, they were also placed in the same area. This contrasted with School A who had decided to place their first system on a trolley and operate it within their classrooms. After

Table 5.15 showing the advantages and disadvantages of system locations

from McDevitt (1994)

Centrally sited system		System on a trolley	
Advantages	***Disadvantages***	***Advantages***	***Disadvantages***
Able to listen to sounds, create effects without distracting others			Necessary to use headphones due to noise of system in operation
Discussion of work without causing distraction		Discussion as any other shared activity	Headphones made the discussion process more difficult
Pupils are free to work without observation or distraction from peers	Keeping 'on-task' requires good self-discipline from pupils		
	Supervision difficult - record of work may not reflect true level of achievement	Supervision of pupils the same as other activities in class	Staff need to feel confident in use of technology - or availability of help!
Close to library for comparison or explanation of facts on CD-ROM	Work was removed from other class activities. Time spend 'fetching' items from the classroom etc.	Use of CD-ROM integrated into other classroom activities	
Work produced was 'all-their-own'	Achievement could reflect pupils' level of competence with system rather than original intention	Easy to ask for assistance when problems arose - provided the teacher was familiar with the system	Pupils may be less inclined to 'take risks' or 'explore' CD-ROM in paths that may be considered 'off-task'
Access to multimedia was available to pupils irrespective of staff competence with IT	Class teachers were not involved in the work and only saw the final results	Class teachers had chosen to use the machine. Its place in the classroom encouraged familiarity and involvement with the system	A multimedia machine can be a distraction to other pupils
A large number of pupils obtained access to the machine	Difficult to assess their use of it except by printed records.	Pupil access was reliant on staff choice and relevance of material available	Staff were more involved with the use of the machine although records of achievement were mainly by print-out

observing both methods of operation in 1994, the researcher (McDevitt, 1994) identified advantages and disadvantages of each as shown in table 5.15

However, school B considered the resource area to be their preferred method of operation and by 1996, there were four systems operating in this central area. These four systems are the first thing a visitor sees when entering the school and certainly create an impact. Although school A actually has more multimedia systems, they do not create this immediate impression as they are tucked away in the class bays amid the children. The use of the multimedia computer was one of the activities set for the children during the school day and children used it in the same groups for much the same time as more traditional tasks within the classroom. The systems were still used without overt adult supervision but it was noticeable that some of the advantages, such as privacy, ability to make as much noise as needed etc. were no longer as obvious. One system was usually in use by children at Key Stage 1, mainly for multimedia reading books. These titles were attractive to children of all ages and sometimes children from other groups were distracted from their task to this system. In addition, some of these younger children had short concentration spans and their attention would wander to the other machines, especially when using the system in groups of three or more. This was often prompted by the sound effects from those machines. As might be expected, it was the child on the fringe of the activity whose attention wandered, The child controlling the mouse had their attention fully on the screen, as also did at least one other child who was generally engaged in discussion with the 'mouse controller'. It was the child who sat to the side of the screen, whose suggestions were perhaps ignored or who chose to be a passive observer. From passive observation of their own system, they were observed to move to interested observer of another system; the increased use of 'ambient sound' on CD-ROMs was often the trigger to this change.

The multimedia system in the main part of school D was also used in an open-access area, outside the classrooms. However, this was supervised by a parent helper who

was able to react to the responses of the children. She changed mouse control, seating, as well as the activity itself to suit the needs of the children.

5.3.5.b Systems sited in the classroom

The other schools operated their multimedia systems within the classrooms. All had quickly discovered the problems associated with this decision as shown in table 5.15. The use of headphones offered only a partial solution, since it was not helpful when discussion amongst the group members was required. Most observations were made where the speaker volume was kept low enough not to prove too distracting to others. Only in the unit of school C was it felt necessary to screen the machine from the rest of the class so neither the eyes nor ears of the other pupils could be distracted. Most of the children being taught within the unit wear extremely powerful hearing aids which both pick up and amplify any sounds, thus raising the background noise in the room. Although the children in other parts of the room may have been unable to make sense of the sounds emanating from the multimedia computer, they could be expected to hear sudden, unexpected noises and would naturally turn to the source of noise, breaking their concentration on their own task. However, during the period of the case study, this requirement became less strictly observed as the children became more accustomed to the sights and sounds of the system.

School A

When school A obtained their first multimedia system, this had been moved to whichever class required it through the school. At the start of the current case study, further systems had been obtained to enable their allocation to particular areas and year groups in the school. Each system was still mounted on a trolley so it could be moved to other bases if needed. One system was with year 6, one with year 5 and the remaining system shared between the Booster Unit and years 3 and 4. In practice, this last system was mainly used by the unit. The decision concerning this allocation had been made by the Headteacher in consultation with staff and reflected the

material available and staff interest in its use. By the latter part of the year, two further systems had been purchased so each year base, and the unit, had its own multimedia system. However, the Headteacher had noticed that the system in year 3 was little used. It was his intention to discuss this matter with year 3 staff to discover the reasons for this and possibly to transfer it temporarily to year 6 where it would be fully used. This was an example where the active interest of the Headteacher, although no longer the nominal IT co-ordinator, was a vector for change. In fact, the decision to remove the system from a year group was perhaps one that could only be made by the Headteacher himself.

School C

In school C the multimedia system was with the IT co-ordinator. She currently had a year 3 class but was changing to year 6 in the coming year, taking the system with her. She felt that the material available would be more applicable to this age group, the children were older and better able to use the system independently. Her next planned next stage was to share the multimedia system between the two year 6 classes. However, the practicalities of this had not been decided.

The units

In all the units, the multimedia systems were in addition to ' basic class computers' and used for a range of activities, not exclusively using CD-ROMs, where they offered enhanced facilities over the older machines. Their use was perceived as an intrinsic part of the operation of the unit and needed within the main work room - even in school C where it was shielded from view. All three units had a higher staff to pupil ratio and made wider, more individualised, use of IT than mainstream classes. In addition, they used a mixture of operating systems to provide a much higher computer to pupil ratio. Staff also considered that they needed to be able to observe pupils as they used the computers. In this way they could observe **how** pupils tackled some tasks, offer assistance when needed,as well as ensure pupils were on task - and that it was the **right** task for that **individual**.

Table 5.16 showing location and uses of CD-ROM systems in the schools

school	group	siting	supervision	main use/s	notes
A	year 3	between class bays	either class teacher	reading books dictionary some topic creative art	not used as much as by older pupils
	year 4	between bays	either class teacher	creative art reading books Topic	Tudors
	year 5	between bays	either class teacher	music History of art encyclopaed. Topic	?
	year 6	between bays	either class teacher	encyclopaed. Topic	Egypt, Victorians
	Booster Unit	in room	unit teacher	reading spelling art maths	prob solving + skills
B	R/year 1/2	Resource area		reading books prob. solving	Rabbits at Home
	Year 3/4	Resource area		dictionary Topic-various	Nominal allocation but
	year 5	Resource area		Topic-various	systems shared
	year 6	Resource area		Topic -various creating multimedia	between the years as needed
C	year ?	classroom	n/a	Topic - nature	Archimedes
	year ?	classroom	n/a	not used	used for NC
	year ?	classroom	n/a	not used	strands
	year 3	classroom	class teacher	Topic encyclopaed.	It co-ordinator
	Unit	unit main room	teacher or assistant with small group or individual	Topic encyclopaed. dictionary audiology maths	always used with adult help
D	years 1/2	in shared area outside classrooms	parent helper	language and maths games	always with supervision
	Unit	in main room	unit teacher or assistant - if needed	problem solving communica'n	often pupils only

5.3.6 *What were the group dynamics?*

Almost all of the observations were made of groups of children, rather than individuals, using the multimedia systems. Only in the unit in school C was the multimedia system used by individual pupils - and this was always with adult support. From the observations, there appeared to be three interlinked factors that affected the successful operation of the group activity:

- the size and organisation of the group
- the nature and duration of activities
- the control of the pointing device.

5.3.6a What size were the groups and how were they organised?

With very few exceptions, the groups consisted of children of similar ages and abilities who were accustomed to working together at other classroom activities. Staff considered that this made for simplicity of organisation as well as contentment of pupils. However, the size of the groups observed varied from one to four. Interestingly, the usual group size reduced over the period of the observations. In 1994, the researcher observed that school B timetabled pupils' use of the multimedia computer in groups of four, McDevitt (1994). By the start of the current observations, the timetabling was less formal and pupils generally accessed the machines in groups of two or three. The only occasion when pupils were observed using a machine in fours was when an older pupil was designated to help younger ones become familiar with a program. This reduction in group size may also have been influenced by the age of the users for the younger children were able to sustain interest for longer when they were more involved in decision making and there were frequent changes in mouse control, as occurred in smaller groups.

When interviewed, teaching staff considered that although the group size of four was convenient for classroom organisation, the children gained more from the experience

if they worked in pairs. This fitted with the researcher's own observations, that in a group of four, at least one child lacked involvement with the task.

In 1994, School A had started using CD-ROMs in groups of three and had reduced the groups to pairs as reported by McDevitt (1994). Throughout the period of the case study, pupils in the main part of the school continued to use the multimedia machines in groups of two with occasional use in threes. e.g. for cascading information about new software by an 'experienced' user was helping two 'new' users.

In the main part of schools C and D, pupils used the multimedia machines mainly in groups of three which staff felt to be a 'workable' number of pupils although, as yet, staff did not feel they were sufficiently experienced to make definitive judgments on group size.

These groupings fitted closely with those reported by the survey where most schools used their systems with variable groups of up to three pupils, although a number always operated them in pairs.

In all three units, CD-ROMs were frequently used for different purposes from the mainstream classes and this was reflected in the group size, which was much smaller. The tasks were more individualised; pupils frequently used the CD-ROM on their own or with 1-1 adult support. In addition the group size was chosen by staff to take account of the children's needs. e.g. Although the pupils used CDs for tasks such as information collection or exploration, these tasks often had a 'hidden agenda' of communication development and the group size was restricted accordingly. Similarly, hearing impaired children needed to observe the faces, and often the hands, of the other members of the group. Adults assisting these children also needed to take care with their position so both children could see them clearly and make sure that they had eye contact with them before they 'spoke'. This was much

easier to achieve with just two pupils, since the presence of an adult also added to the effective group size.

Due to the much higher adult to pupil ratio in the units, it was possible to offer a level of adult supervision and/or assistance that was not possible within the mainstream classes. However, due to their communication and/or learning difficulties these pupils had an increased need for adult help, especially as most CDs were designed for the 'fully-abled' child. When the CD was designed to address the pupil's difficulty, such as the multi-sensory spelling software for pupils with specific learning difficulties, then overt adult supervision was not needed, or provided. This was also true with some mainstream CDs such as Silly Noisy House that did not rely in the use of skills or senses that the children lacked.

The final factor in the level of adult help provided was the confidence that adults had in the children's competence and familiarity with the equipment.

5.3.6b The nature and duration of activities

The time taken by pupils to complete an activity using a CD-ROM varied according to the task, age of pupil etc. Staff often provided pupils with worksheets or cards, not unlike those they might use for more traditional information gathering activities. Although the time needed for the activity was not always comparable with the traditional task, due to difficulties with navigation etc., when the computer was used within the classroom, staff could observe the problem and adjust the time allowed, or the activity, accordingly; they could also make changes when the children's concentration span was exhausted. However, the task of getting both the activity and time correct became more difficult, particularly for younger users, when the children used the system outside the classroom.

In **school B,** the children were not only outside the classroom but unsupervised by adults as well. There is an emphasis on self-discipline and control within the school which undoubtedly contributed to the success of this system with the older children. However, there was a greater range of concentration span among individuals within the younger age groups, which provided an added complication.

The school encourages personal and group organisation by the children. Just as in a classroom activity, the group members were expected to share the task 'fairly'. Some groups would choose to change over 'mouse control' more often than others. In this situation, most of the group members might, at some time become more interested in the other systems but would instantly snap back to interest in their own task if offered control of the mouse!

The children were aware that they were expected to remain with their activity for an allocated timespan but some children simply could not sustain interest, especially where there were infrequent changes of task among the group members. In the absence of staff supervision, the 'wanderer's' attention was not drawn back to the task, nor could they be moved to more gainful employment, as occurred in the classroom. However, although these children did not pay attention to the task they were set, neither did they prevent other groups from getting on with their task.

School D also operated their system in a resource area with very young children. As in school B, there was usually a range of concentration spans within the group members. However, unlike school B, the system was used with supervision from an adult voluntary helper. In this way, control of the mouse was changed and even the seating of the pupils changed to keep the children on task. As she also provided the applications, she was very familiar with them and the time they could be expected to occupy the children's interest. The software used was less open-ended and shorter in duration than that used by school B. Sometimes the children repeated an activity but the helper would change to something different if she felt that they were becoming

bored. Although the children were kept on task, all decisions concerning the seating of the children and control of the mouse etc. were with the adult not the children.

A further difficulty with the use of the multimedia system outside the classroom for a prescribed period was that some of the youngest children could not tell the time! This problem came to light when a group of children were observed at the computer for an unusually long time. They became increasingly bored with the activity but stayed beside the machine - until rescued by their teacher! It then became clear that they had stayed for twice as long as expected, since neither they, nor the group who should have replaced them, were proficient at telling the time! Subsequently, the younger children came to the computer with a stopclock and the instruction to 'go back to class when the hand pointed to a given number'. This strategy seemed to work well since they recognised numbers such as 10, 20 etc. and also their order.

5.3.6c Control of the pointing device

All the CD-ROM titles observed being used were navigated using a pointing device. Usually it was a standard mouse but both schools A and B had been provided with trackerballs with their 1995 DfEE initiative PCs. These alternative devices are often used by people with fine motor control difficulties as the complex, one-handed movements needed to operate a standard mouse are separated into parts that can be operated by different hands, or people. NCET had decided on their provision since they anticipated the systems to be used by children at Key Stage 1, where some pupils could also be expected to have less well-controlled hand movements. Although very common in special schools, these devices would be unfamiliar to many mainstream primary schools and neither schools A or B were aware of their possible advantages or how they should be used. This may explain why School B had replaced it with a standard mouse whilst school A were using it, but considered it cumbersome. Although the researcher showed staff and pupils in both schools how to operate the device, two-handed, the pattern of use (or non-use) had by then been

established. Whichever pointing device was used, it was always operated by one child who, as explained in chapter 6, had a controlling influence on any activity.

Whatever size of the group, it was noticeable that the child with control of the pointing device was always completely involved in the task, sometimes to the exclusion of any outside opinions or discussions. In some groups, mouse control was shared evenly between the members of the group; the changeover occurred without rancor, often at the initiation of the mouse controller themselves. However, other groups were observed where a more dominant child would take control of the mouse, and hence the group, but did not relinquish control. In these situations, there was frequently an on-going discussion between the mouse -controller and one child sitting beside them. This second child sometimes seemed to prefer to leave the actual mouse operation to the mouse-controller, whilst they were able to concentrate on the effects of their joint decisions. Meanwhile, the child or children at the edge of the group were observed to become uninterested, lose track of the task and hence the 'mouse controller' was able to continue in his or her role, with or without the help of a second child. In this manner, the group of three or four, reduced itself to an effective group of two.

Some children became unintentional 'mouse dominators'. They were sometimes so involved with the CD-ROM that they forgot about the rest of the group, except for at most one other child. However, if prompted by an observing adult or child, they would pass the mouse to another group member quite readily, but continue to take a very active part in the task. Subsequently, mouse control passed more 'fairly' around the group. By contrast, there were a few children who appeared more intentional in their ' mouse domination'. Even when reminded, they were not able to share control so easily. One child actually continued to keep his hand over the mouse, over the hand of whichever child was supposedly controlling it. In this way, he continued to make all the decisions since he pushed down on the child's finger, and hence the mouse button, as he wished. As he was slightly older than the rest of the group, and

had been tasked to show them how to use the package, the rest of the group did not question this behaviour although some children visibly resented the interference.

In pairs, this dominance by one child occurred less often. This may have been in part because the children were usually friends and often worked together. Also, children working in pairs were more commonly observed to remark 'It's my turn NOW', when they felt that the other child had controlled the mouse for too long.

In larger groups, the situation was less simple to resolve for when a child retained control of the mouse for a long time, it was not uncommon for the other children to have forgotten whose turn it was next to control the mouse, by the time they finally persuaded them to relinquish control; this problem did not arise with pairs!
Although the researcher did not feel that it was not possible to make fast rules concerning these three factors individually, it appeared that the way in which they were combined greatly affected the success of any activity. e.g. large groups could work successfully if there were frequent changes of mouse control and the task was appropriate for that group. The following diagram attempts to show that a group can work effectively if the three factors slide along the arrows so there is an overlap within, but not exceeding, the circle of success.

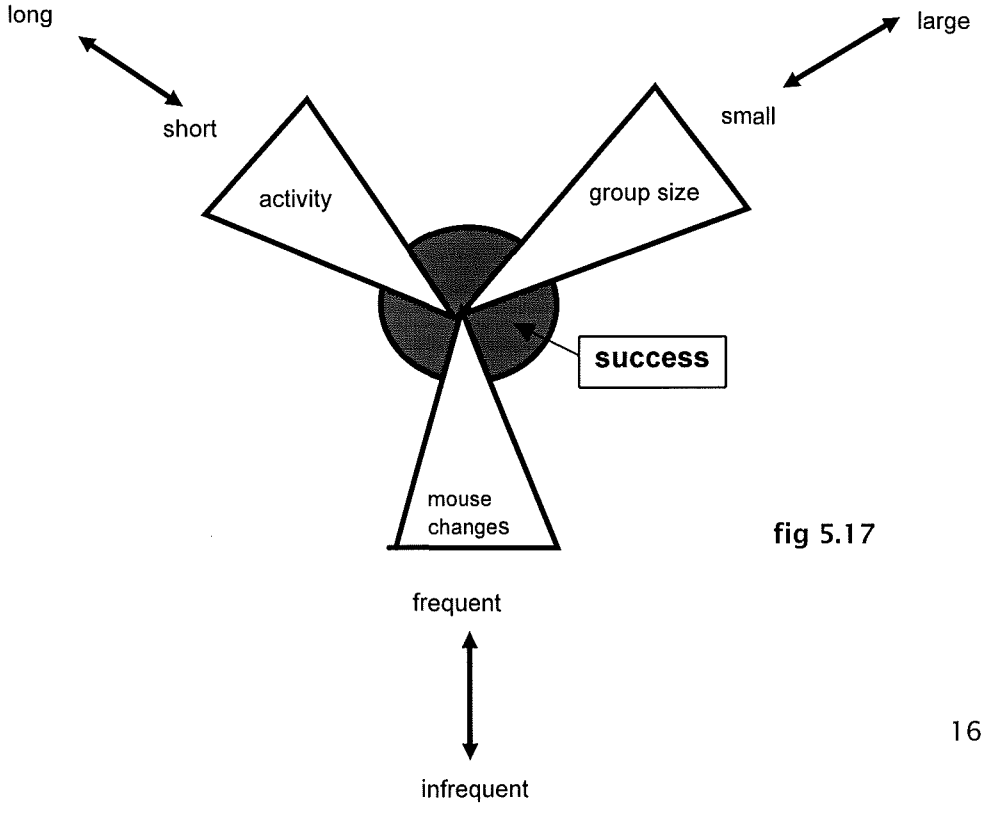


fig 5.17

Summary

In this concluding section, the researcher has attempted to draw together the main points of the preceding chapter. After an initial paragraph summarising the case study schools, the following sections are organised under the headings of the first research question.

Background to the four schools

The case study schools were located within the area covered by the postal survey. They were of similar size and had similarly mixed catchment areas. Three of the schools included units for pupils with special needs within their main buildings; the level of integration of those pupils into the mainstream classes varied according to the needs of each individual. The units in schools C and D were funded by the LEA to meet the needs of hearing impaired pupils whereas the unit in school A was funded by the school itself and included high attainers as well as those with learning difficulties. All of the schools were considered to be examples of good primary practice but this was not necessarily in the area of information technology. All four schools had written IT policies for delivery of the national curriculum but these policies varied in detail and level of implementation throughout the schools. e.g. the written IT policy of the unit to school D incorporated the additional uses that were made of IT to address the specific needs of their children. Although they were all equipped with at least one multimedia computer system, there was a wide range of experience and confidence in the use of the technology. However only schools A and B provided staff with additional information concerning ways in which available software could be used across the subject areas of the national curriculum.

How and why was the use of CD-ROM technology initiated in the schools?

Although all four schools received multimedia systems under a government initiative, the systems arrived at different stages of their use of the technology. Schools A and B had initiated the use of the technology themselves and their achievement with it

enabled them to successfully bid for government funded systems. Although School C had received a system under the 1994 CD-ROM in Primary Schools Initiative, the technology had not been well received and the computer was operated as a non-CD-ROM system within one classroom. CD-ROM technology was effectively initiated in Schools C and D when they purchased multimedia PCs, with LEA assistance. At this time, their respective units obtained CD-ROM systems. However, one system was ostensibly for staff administration but was used for the benefit of pupils during the school day; the other was on loan from an institute of higher education. Only school A had purchased a multimedia system for their unit pupils; this was also the only unit that had been set up by the school itself, rather than the LEA.

What equipment (hardware and software) was available?

The general IT equipment within the schools reflected both their LEA and the schools' own policies. Each class was provided with at least one computer system; however the two schools (A and B) where the IT co-ordinator was also the headteacher provided at least two systems. Three of the schools provided classrooms, or bays, with computers using only one, modern operating system. They also had a few computers using alternative operating systems that were used for specific curriculum purposes. School B appeared to have more computers in total than the other schools but they were of varying ages and operating systems. However, these computers were organised so that a single operating system was used by the whole year group.

Although the units had a much higher computer/pupil ratio than the mainstream classes, the computers themselves tended to be older. School A provided its own funded unit with a multimedia system whereas charities and fund-raising provided the usual source of new equipment to the LEA funded units.

At the start of the observations, only one of the case study schools had more than one multimedia system; however further systems arrived, both purchased and

provided by government initiative, during the period of the observations. These findings were very similar to those of the postal survey.

The schools all added printers to their CD-ROM systems. Existing junction boxes and headphones were also added by school A, as they were operating their systems within open-plan class areas. Although little used during the period of the observations, both schools A and B had added a video card to one of their CD-ROM systems. The unit of school D attempted to add a spyball camera to their system but found this inoperable without considerable upgrade to their loaned CD-ROM system.

Most CD-ROMs are navigated using a pointing device, usually a mouse. Through government initiative, both schools A and B had been provided with alternative devices that are often considered easier for young children to use; however, neither school used them.

There was a considerable difference in the number of CD-ROM titles available in the four schools. Schools A and B had both received a selection of titles with the machines they obtained from government initiatives; they also purchased many more titles themselves and had policies for the on-going purchase of software. Schools C and D had not obtained CD-ROM titles with their systems and the titles they used were provided on loan by staff, a parent or the researcher. However the units and school D had allocated some funding for the subsequent purchase of software that had been found to be successful.

How, and by whom, were decisions made concerning purchase and use of equipment?

Responsibility for IT rested with the headteachers in two schools (A and B), and one unit (D), but was elsewhere devolved to classteachers. This resulted in considerable variation in both the funding available as well as the emphasis placed on the use of IT

within the four schools. There was also a corresponding range in the levels of IT confidence and competence by staff and pupils across the four schools, reflected in the respective OFSTED reports.

In most cases, the ultimate decision concerning purchase of CD-ROM titles lay with the head of the school or unit but advice for future purchases was sought from a variety of sources; BETT exhibition, LEA advisors, the researcher and personal recommendation by staff, parents and pupils. In schools C and D, purchasing decisions were made by the IT co-ordinator but within the funds allocated by the headteacher. With limited budgets, they felt the need to spend wisely. The absence of a definitive list of CD-ROM titles was keenly felt by the IT co-ordinator of school D who had previously adhered to a strict policy of purchasing only 'LEA recommended' software. This problem appeared not to have arisen in school C; however, as the IT budget had been spent on the multimedia system itself, there were no funds available for software purchasing that year! Although details of purchasing responsibility was not given by the survey, the responses also revealed widely varying purchases of hardware and software.

Where and by whom was the technology used?

As found in the postal survey, the case study schools placed their multimedia systems either in an open resource area or within classrooms. Schools B and D operated their multimedia systems in open resource areas, whereas schools A, C and the units operated their systems within teaching areas. The plan of the school may have played a part in such decisions for it was less practical for schools on sloping sites to move CD-ROM systems from one classroom to another. However, geography may not have been the only factor; the open area used by school B was immediately visible to all visitors as they entered the school and created a considerable impact.

Systems that were operated outside classrooms were unable to be supervised by teaching staff. A parent volunteer provided such supervision (and the CD-ROMs) in school D but school B were able to successfully operate the systems unsupervised. The strict timetabling of pupil groups plus the school's culture of self -discipline may have contributed to this success.

The sounds generated by the CD-ROMs caused fewer problems when the systems were used outside the classroom. However, when school B had all four systems in operation, some pupils were distracted by the noise from nearby systems.

Finally, staff in these schools were unable to observe the pupils as they operated the systems and could only judge their achievements by written evidence. It was also found necessary to provide comprehensive notes on the navigation of each CD-ROM, particularly with older pupils using the more complex titles.

Casual supervision of pupils was easier to achieve when the multimedia systems were operated within the classrooms, as was the integration of the work into other class activities. Staff were able to be more flexible in the time allocated to each group and it was easier for confident staff to assist pupils when they encountered difficulties. However, the noise from the systems could prove distracting; headphones were a partial solution but limited group discussion. Unlike school B, access to the multimedia systems was not the same for all pupils. Even in school A where there was eventually a multimedia system for each year group, not all staff used those systems to the same extent, some hardly at all. In school C, the multimedia system doubled as a class computer and it was only used by that one class and had a different operating system from the rest of the school.

In all four schools, pupils accessed the multimedia computers in groups of two or three, just as reported by the survey. Schools A and B had started using the technology with groups of four but had reduced the group size in the light of

experience. Only in school B were those groups timetabled. The tasks set using the systems were usually linked to other national curriculum class activities. Only in the units were the systems used for more specialised purposes such as communication development or empirical audiology.

The duration of the pupils' use of the CD-ROMs varied with the age of pupil and task set. However, the time taken to complete a task could not always be judged from the traditional equivalent task since pupils sometimes found unexpected problems with navigation or simply lost concentration. (Further details on these matters will be found in the next chapter). When staff could observe pupils working, it was relatively easy to adjust the task or time but more difficult when the system was used in a resource area. If specific periods of time were allocated to groups, it was necessary to ensure that young pupils had a way of knowing when that time was finished.

Whatever the size of the group, it was noticeable that the child who controlled the pointing device, also controlled the activity. That child was completely involved in the activity, sometimes to the exclusion of all outside opinions or discussions. Although children were expected to rotate this control though the group, some individuals were more reluctant than others to relinquish this control. These problems rarely occurred when pupils worked in pairs. In larger groups, it was possible for two children to dominate and reduce the group task to a paired task plus disinterested observers. If larger groups were to be successful, it was necessary for the task to be quite short and for the mouse control to be changed frequently.

Additional information concerning the way in which CD-ROM technology was being used in the case study schools will also be found in the following chapter which concerns the researcher's observations of pupils using CD-ROM technology. Although these observations predominantly address the second and third research questions, aspects of the way in which the equipment was being used will be re-visited.

Chapter 6

Observations of Pupils in the Four Schools

Using the methods of data collection discussed in Chapter 3, observations were made of pupils across the age range in the four schools over a period of four terms. Although differences were noticed between the four schools, a pattern of use of CD-ROMs over the primary years emerged. Since this is an evolving, and ever changing technology, there were also changes in both the titles and the uses made of those titles by the latter part of the case study. This section looks at the broad pattern of use of multimedia technology by the four schools and compares that with the findings from the survey. Categories of use at different age and development stages are established which are then examined in greater detail, using examples of observations from the schools. The final section looks at the uses of multimedia within the specialist units and compares them with those of the mainstream situation. The findings from this chapter are brought together in a summary.

6.1 How did they use the CD-ROMs?

Although multimedia technology had been available to the schools for a similar period of time, the extent to which the technology was used varied widely from school C where the technology was effectively only being introduced (or re-introduced) to schools A and B who might appear to be very experienced users. However this impression may be deceptive since there were parts of the schools for whom its use was relatively new.

Despite these differences, a pattern of the use of simple, easy to access CD-ROMs for initial experience, leading to further experience using more closely focused information sources was repeated by the schools in the case study. Although the technology had been introduced to schools A and B before the commencement of the case study, McDevitt (1994) reported that both had used a CD-ROM for this purpose. As this introduction also pre-dated the availability of multimedia reading books, they

had used broadly focused information sources and not extended the use of the multimedia system to the lower part of their age range. Between that initial study and the current work, both schools had 'discovered' the Living Books and had used them across their whole age range; mainly for pleasure with the older pupils and as an introduction to the technology with their younger children.

Having established the technology, the schools moved towards a pattern where the use of CD-ROMs was more closely allied to the age and development of the child rather than their experience of the technology. Younger children's use was still mainly confined to the multimedia books but they moved towards the use of CD-ROMs as source of up-to-date information as soon as possible. In some ways, this parallels the children's use of traditional reading material. However, whereas there is a range of very simple reference material available in traditional form, staff in all four schools expressed concern about the lack CD-ROM titles with comparable reading and interest age. Since the first DfE initiative in 1994, the range of titles appropriate to the Primary age range has increased dramatically. However, staff still expressed dissatisfaction with the range of material appropriate to Key Stage 1. Although the multimedia reading books were popular with both staff and pupils, there were few CDs offering information on National Curriculum areas that could be used by these young children without adult help. Even at Key Stage 2, it was felt that the text on many CDs was at too high a reading level for the pupils. None of the schools had, at that time, found a satisfactory multimedia encyclopaedia - all the schools with Key Stage 2 pupils used Encarta - but only under adult supervision and predominantly for the pictures and videos. This reinforces the researcher's own appraisal of the reading age of this CD as shown in appendix 3 as in excess of 15 yrs!

These findings compare well with those of the survey. The returns indicated that schools were using the reading books, with their simplicity of use and wide appeal, to introduce pupils to the technology. Having achieved this objective, the 'information sources' were used as part of a particular topic. Hence a CD-ROM might only be used

by a single year group. As can be seen from fig 6.1, one of their most important criteria in judging a CD-ROM was its relevance to the National Curriculum.

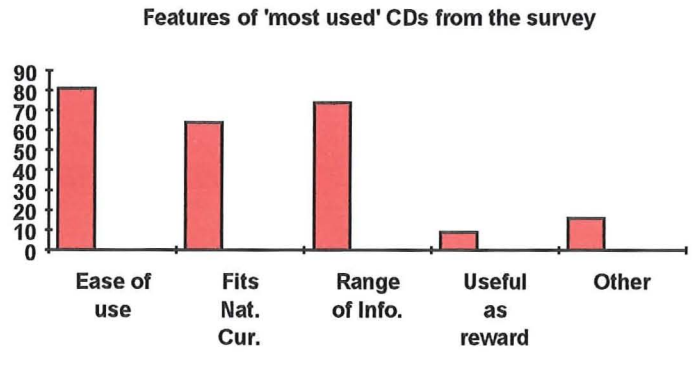


Fig 6.1

The only information source that was used by a wide age range was Encarta, perhaps because it provided information on a wide range of subjects. Further, the overwhelming reason for rejecting certain CD-ROMs was that they did not fit into the National Curriculum, as shown in fig 6.2.

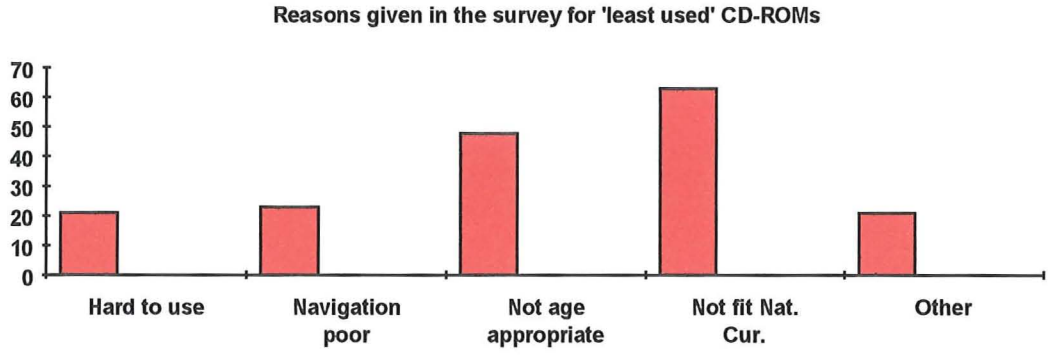


Fig 6.2

The relevance of a CD-ROM to the delivery of the National Curriculum was also important to the schools in the case study. The purchasing policies of schools A and B were aimed towards the acquisition of CD-ROM titles to assist in the delivery of the National Curriculum, particularly in those subjects where a topic-based approach was used. Perhaps because the IT co-ordinator in both schools was also the headteacher, they appreciated that having the CD-ROMs on the premises was not enough. Details of relevant CD-ROMs were being included in the staff topic guidance folders of school B whilst school A provided staff with a list of CD-ROM titles that included information on relevant areas of the National Curriculum plus guidance on 'age appropriateness'.

By the upper junior age, pupils mainly used the CD-ROMs as an up-to-date source of information, usually linked to National Curriculum work in Science or Humanities. Children said that they preferred using the CD to more traditional sources such as books, often adding that books did not have sounds and videos like the CD. Some of the CDs used were multimedia versions of books that were in the school library, such as some of the Dorling Kindersley titles. Although adults remarked on the similarity between the screens of the CD and the pages of the books, children did not seem to recognise the similarity but stated a preference for the CD-ROM.

The presentation and organisation of the information on the CD-ROMs varied from the use of the traditional alphabetically arranged index to simulations where the information was presented as 'discoveries'. Different skills were needed for these approaches and since there was no uniformity of screen organisation, one of the first tasks children were given was often simple browsing to become familiar with the layout and operation of any given CD-ROM.

The observations of pupils were predominantly used by the researcher to attempt to obtain answers to the last two research questions, namely:

- ***which CD-ROMs were being used, and for what purposes?***

  2a) How were pupils introduced to the use of CD-ROM technology?

  2b) How did they learn the information-finding skills to use a CD-ROM effectively?

  2c) How did the use of CD-ROMs change through the primary age range?

- ***what changes have resulted from the use of CD-ROMs in primary schools?***

  What changes has their use made to the delivery of the curriculum?

  Did their use change the ways in which pupils collected and recorded information?

The observations of pupils from the four schools have been divided into the following sections where the bracketed number shows the research question(s) addressed:-

Introducing pupils to the use of CD-ROMs (2a and 2c))

Learning the information-finding skills needed to use a CD-ROM effectively (2b)

Use of CD-ROMs for information with younger pupils (KS1/2) (2c)

Use of CD-ROMs for information with upper junior pupils (2c)

Specialist uses of CD-ROMs (2a, b and c)

The changes that resulted at each stage from the use of CD-ROM technology are discussed within each of these sections. The summary to the chapter brings the findings together under the research question headings.

From the many observations that were made of pupils in the four schools over the period of the case study, typical examples have been chosen to illustrate each subsection. Most of the CD-ROM titles were observed being used by more than one of the schools so it was possible to compare and contrast the different uses; including comparison between its use in a mainstream and specialist unit setting. However, due to the age and language development of the pupils, plus hardware incompatibilities, the CD-ROMs used by pupils in the unit of school D were used by no other pupils. Although they could be said to be used for information retrieval, this was by staff of the pupils and is described in a separate section, specialist uses of CD-ROMs, at the end of this chapter.

6.2 Introducing pupils to the use of CD-ROMs

As explained in section 6.1, the case study schools introduced pupils to the use of CD-ROM technology by the use of simple, easy -to-use activities. This approach mirrored that reported by the survey. This section details three typical introductory activities using :

multimedia reading books

an art package

a pre-programmed tour.

Of these, the use of a multimedia reading book was most commonly observed.

6.2.1 Introducing the use of CD-ROMs using multimedia reading books

From the survey, it was clear that many schools used the multimedia reading books to introduce the technology to a wider age range of pupils than might be expected from the stated interest/reading age on the package. The Living Books in particular were considered to be simple to use and fun, whilst enabling pupils to learn the basics of CD-ROM navigation. This idea was also used by some of the case study schools where it was possible to observe not just that they were being used, but how and why this was happening.

Almost all of the titles used were designed for the home market rather than school use, and often the American home market at that. Children seemed less aware of the American accent than their teachers; however, during the period of the case study, it was interesting to see that one of the most popular Living Books (Grandma and Me) had been republished in a British version with alternatives of French and German rather than the original American English and Spanish. Though this may reflect a perception of a growing European market for such products rather than a response to the opinions of British teachers!

When school B started using multimedia in 1993/4, the Headteacher did not feel that CDs such as Living Books were appropriate for school use. However, by the start of the case study, this was the main source of material used by the youngest children; the impetus for the change having come from staff, parents and the children themselves.

Schools A, B and the unit in C had all used at least one of the **Living Books series**. They were mainly used as an introduction to the use of CDs with anticipated outcomes of learning :

to control the pointing device

simple navigation of the pages of a CD-ROM

as well as providing an innovative form of reading practice.

In schools A and C, they were observed being used and enjoyed across a wide age range as an introductory activity although, over a period of time, their use focused towards younger children or those with reading/literacy difficulties. This latter use was most apparent in the unit of school C, where the use was mainly to assist in language development.

Children were usually expected to read the story, or part of the story, much as they would a traditional book. However, there was the added incentive of being able to explore the pictures. As each new page is opened, the story is automatically read to the pupils using recorded speech. Without being asked, children would read along with the highlight. Some confident readers silently mouthed the words, whilst the less sure read aloud with the CD. Although the deaf children could not hear the speech, the words are highlighted, so the children signed (and some also spoke) the words along with the highlight.

However, after a few pages, this behaviour became less apparent as they became more interested in the effects produced by clicking on the parts of the picture than

the storyline; some children lost track of the storyline altogether. Few of the children realised that the stories were available in book form and when shown them, did not seem very interested in the print versions.

When children first experienced this type of book, their interest was totally captured as they had seen nothing like it before. Even in the larger groups used by school B, young children remained interested and on-task for quite long periods of time, even when they did not have control of the mouse. There was tremendous discussion of the effects, whoops of joy and much laughter. Favourite effects were played again and again.

The younger children in school B used this type of material more regularly, and over a longer period of time, than the other schools. It was observed that they became 'experienced - users' who were able to predict the effects of clicking on given objects. They had noticed a pattern in the effects and used this knowledge to select objects to click on when it was their turn with the mouse.

Although some children had the CD at home, or had seen it before, they always seemed to enjoy using these books, providing the activity did not last too long. There was a greater range of concentration span within these younger children. As explained in section 5.3.6c,*The control of the pointing device,* children on the periphery of a large group tended to lose interest, especially when they were unable to control the mouse or influence decisions over items to be pressed. When the books were used inside the classroom, staff were able to react to signs of waning interest and make changes in the group, ensure sharing of mouse control etc. However, this was not possible when used in a Resource Area, as in school B. A few children took themselves back to the classroom when they became bored whilst others occupied themselves in contemplation of other groups working in the area, conversation with passing children or appeared to slip into a daydream until they regained control of the mouse.

Pupils in the Hearing Impaired Units had not been expected to enjoy Living Books since staff were aware that they would not be able to appreciate the speech or the musical effects. In practice, they delighted in them, in their own way. Here were 'reading books' that offered funny visual actions that they **could** appreciate. Although an adult helper was always on hand to explain something they did not understand, they soon became less necessary because the 'sound-only' effects were treated as one of the many other things in the picture that did not have an effect, and most of the actions had visual as well as sound effects. Many of these sounds are simple and loud, such as the buzz of the aeroplane flying in Arthur's Teacher Trouble. When combined with the animation, they could be appreciated by some of the pupils. In fact, these were the effects that were most enjoyed.

One title in this series that appealed strongly to both staff and pupils of the hearing impaired unit of school C was **New Kid on the Block**. The poems were simple and funny; as the poem was 'read', it was explained in a simple animation and in addition some of the words were explained by further, very visual, animations. Although deaf children often assume, and know, only one meaning for a word, they laughed uproariously when they clicked on the word 'behind' and saw what the child on screen pointed to! Staff could see considerable potential for this style of presentation where the words were explained visually. Unfortunately, it has not been repeated in any of the other Living Books; indeed later titles appear to contain more 'sound- only' effects and re-telling of the story which may be more appealing to the majority audience who are younger and have normal hearing.

All the schools in the survey who received an Acorn system used, and liked, the multimedia 'Naughty Stories'. At that time, these British stories were not available for the other platforms so PC and MAC users were provided with Living Books. Although the latter were very popular with the vast majority of schools, an objection that was voiced by a few schools was their use of American English. This view was also reported by Sparrowhawk and Heald (1995) in their review of the initiative and in the

subsequent DfE 1995 initiative, the PC and MAC packages of CD-ROMs for primary schools included '**The Rabbits at Home**'. This CD-ROM was of a similar type, aimed at Key Stage 1 (KS1), but with English voices. In this CD, young children can explore a day in the life of a family of rabbits (but really just like a human 'nice' family) living in a detached house in the country. As they move around the house, the children click on objects and obtain visual effects or sometimes be offered puzzles to solve. The visual effects were much like Living Books but were less zany and often with sound-only effects; the puzzles were age appropriate and it didn't really matter where, or in what order, they explored as they encountered similar problems.

Children in school B, who were observed using this CD-ROM, appeared to enjoy it and obviously recognised the situations such as family meals or brushing your teeth in the bathroom. This scenario was familiar to these suburban children but from the researcher's teaching experience, she considered that it might be less successful with pupils from an inner city area where the scenes would be less familiar.

One difficulty that arose during the observations was due to the presence of an older child who was supposed to be showing the way the CD 'worked' to the younger ones and then helping them, *if needed.* In practice, he kept control of the mouse and did everything - the others just watched and became bored. One child was noticed to become bored much more quickly than the rest of the group.

Although this is an age-appropriate CD, it is very dependent on listening skills and hearing. There is no text or symbol/picture to back up the spoken instructions which are given in a soft voice. The researcher noticed that one child did not seem to react to the voice at all. Later in the work he came to a puzzle involving listening and matching which he found very hard. The speaker said 'click on the orange' but the child said 'apple' and clicked on it - and was very surprised to find he was wrong. There were further indications of this child having impaired hearing or speech/language problems. (His speech was quite flat; he often left out the small

words; he also understood questions if the researcher ensured that he had eye contact and could see the speaker's mouth.) At the end of the session, his teacher was keen to discuss this particular child's use of the CD-ROM with the researcher. She was also concerned about his hearing and speech, which was later diagnosed as a conductive hearing loss. Unlike some other CDs, where children with hearing loss could still understand and participate in the activity in their own way, The Rabbits at Home was so speech-dependent that even a mild loss seemed to have a marked effect on the child's ability to comprehend the activity.

The researcher also noticed the behavior of the children as the screen changed. Like Living Books, there is a wait of a minute or two whilst the next screen is loaded. The children completely lost interest at this point, neither talking about what might happen, nor anticipating the next screen, as had been observed with the Living Books. However, they became immediately interested once there was something on the screen. In part, this may have been due to the fact that three other machines were operating at the same time and one was making multimedia and recording sounds etc. Although the older children did not seem to be affected to the same extent, this proved most distracting to the little ones, especially when the older child in the group would not allow them to actually do anything! However, as the children were working in a Resource Area, staff had no way of knowing that there was this combination of activities.

6.2.2 Introducing the use of CD-ROMs with an art package

The schools were also faced with the introduction of multimedia to older children and their teachers. The pressures on time of the National Curriculum meant that teachers preferred activities that fitted its requirements but were a manageable step for both themselves and the children from previous experience. One strategy that was observed in school A, was the use of **Flying Colours**. This is basically a Paint program with additional features such as a palette that includes cycling patterns of

colours and also the ability to apply rotational symmetry to a design. It was observed being used by year 3/4 children to produce symmetrical patterns as part of their Mathematics work (Nat. Cur. KS 2, Mathematics, Shape Space and Measures 2c).

This was the children's first attempt to use both the software and the technology for an activity linked to the National Curriculum. Its use was initiated by the Headteacher, who worked with the classteacher and children in an area adjoining the class bay. The CD -ROM was part of the existing school stock, being part of the 1995 DfE initiative package. The children were already familiar with the use of other art packages such as Paintbrush and Kid Plx which are available on their network.

Their task was simply to produce a pattern, that they liked, with rotational symmetry. This task was sufficiently open-ended and non-judgmental for everyone to achieve success. The Headteacher has started by demonstrating the package to the class who had been organised into working pairs by the classteacher. He ran through the tools, explained what they did and suggested that they 'play' first and then try to make a picture to print out - use the rotational symmetry tool. The class had returned to their tables whilst he worked with the first pair to produce a pattern and print the result. One of these pupils then remained by the machine to help the next pair and so on. Although the Head was present throughout, as time went on, his help was required less often.

The program produced stunning variable colours on screen but the print outs were quite dull in comparison. As the screen colours were constantly changing, the software appeared to choose one screen at random to print out - some printed rather pale, others very dark. Although they remarked on the difference between the screen and printed version, the children were quite happy to get a print out whatever its appearance - although they soon discovered that it was essential to label each picture as it was produced, since it proved almost impossible to identify their work later!

The children very quickly understood what to do for they were used to other art programs. There was much discussion about what they should do, no-one seemed to lose interest and they were all keen to get their turn with the mouse. The results were very unpredictable. They were allowed to print out once they had achieved a result they liked; but sometimes a child would say that they preferred the pattern that they had achieved some minutes before, had changed and hence 'lost'.

There was an interesting difference between groups. In some groups, each child would quickly achieve an acceptable result, print out and pass the mouse to the next child; in others, the children took much longer changing and rechanging the pattern before they finally decided to print out. These were the children who often said that they actually preferred the pattern they had created some minutes before! Perhaps because the screens were so visually stunning and also constantly changing, the rest of the group sustained interest even with the perfectionists in charge!

This program was highly successful because it was very easy to achieve a superb result on screen. Although the children were delighted with the printouts, which were used to make a classroom display, this software was really designed to be viewed on the computer screen. When linked as a slide show, the changing colours of the children's work could then be appreciated.

Their teacher was very pleased with the results and felt that the children were able to see the effects of rotational symmetry far more quickly using the software than by traditional methods. She had used the CD herself prior to the pupils use and would have appreciated a more detailed guidebook to the software than was provided. Perhaps this is the difference of approach between generations since no child asked for a book or even a guide to the icons, they just pressed buttons and experimented until they achieved a pleasing result. Their teacher felt that she would use this software again, but would like to use it within the classroom rather than in an

adjoining area as she would prefer to be able to oversee the work more easily and sit down with some groups to find out more about their understanding of their work.

6.2.3 Introducing the use of CD-ROMs with a pre-programmed tour

Dangerous Creatures, one of the titles in the Microsoft Explorer series, had been provided to schools with PC systems in the 1995 DfE initiative. This was observed in use in both the case study schools and another mainstream primary. Like other titles in the series, it attempts to cover a very wide field and was originally aimed at the home-market. The 'dangerous' creatures are chosen from a wide range of habitats and include lions, sharks, tarantulas, snakes and crocodiles. The CD-ROM includes a number of 'guides' with whom the user can take a 'tour' of a given habitat to encounter the dangerous creatures found there. This aspect was being used by the schools to provide an exciting introduction to the technology.

Children were observed using **Dangerous Creatures** for very open-ended browsing as well as with a worksheet which suggested the use of a tour and asked the children to note down certain animals and features on the screens. Perhaps because this was often their first experience of this type of software, the children seemed most interested in the pictures and videos. Many of the screens opened with a long spoken commentary. At first, the children listened to this first but after a few screens, they seemed to half-listen to this whilst they scanned the pictures and searched for video icons. If there was nothing of interest, they would move onto the next screen without waiting for the end of the commentary.

They quickly learnt how to browse the CD-ROM and most groups found what they considered to be 'scary animals' - sharks, snakes and spiders being the common choice! Microsoft must have anticipated these preferences since there were videos, sounds etc. on these themes. Teachers were not expecting any depth of information from this CD and their anticipated learning outcomes lay predominantly with

navigation of a CD and appreciation of the different types of media present. Staff considered that they might, in the future, use the CD to enhance a Topic on a particular habitat linked to a National Curriculum area such as Geography KS2 8c. (extremes of weather - deserts, jungle etc.).

However, the researcher's observations indicated that it could prove difficult to search this CD-ROM for information on a particular animal for the range of animals is more limited than it may at first appear. Also, perhaps because this CD-ROM was not intended for serious study purposes, they are referred to by their common (or local) names only. However, one group of children wished to find out more about a particular snake seen on the CD-ROM but were unable to do this, since the name used could not be found in any of the school's reference books.

6.3 Learning the information-finding skills needed to use a CD-ROM effectively

Having learnt mouse control and simple navigation, teachers were looking to use the potential of CD -ROMs to provide information. However, in contrast to the non-fiction books offered to young children, one CD-ROM usually contains a vast amount of information. The difficulty faced by the children was to select the information they required from the rest. The usual 'adult method' relies on the use of an alphabetical or subject organised index. However, as previously noticed by the researcher, McDevitt, (1994), young children are not proficient in the use of such devices.

At Key Stage 1 of the National Curriculum pupils 'should be taught about the structural devices for organising information. e.g. contents, headings, captions.' English AT2 (Reading)

By Key Stage 2, English AT2 Reading, level 3 they should 'use their knowledge of the alphabet to locate books and find information.'

Although the use of IT-based information sources is specifically mentioned in the National Curriculum, the teachers questioned had found few age-appropriate CD-ROM titles at levels 3 and 4.

Schools A, B and the unit of C were using Dorling Kindersley's **First Amazing Dictionary** with pupils at level 3/4. By year 3, pupils were being taught alphabetical order and simple dictionary work using traditional print dictionaries. This CD offered an opportunity for practice of this skill as well as an opportunity to learn the skills of browsing and navigating a CD-ROM.

Pupils in school B were provided with a simple workcard of words to find on the CD. The workcard itself was very similar to one that might have been used with a print dictionary; however, instead of explaining in their own words (or copying out) the meaning of each word, they were asked to find the words and print out the screen of the one they liked best. The words they were given were linked to the current topic on 'buildings'.

Although they started with the first word on the list, they did not continue in this order. In some cases, this was because when they found a word such as 'house', this offered an other word on the list - 'door'. On other occasions, they had difficulty finding the required word from the alphabetical index. Like a standard dictionary, the words beginning with each letter are arranged in alphabetical order to the second and if needed, subsequent letters. Although the children used the alphabet confidently to locate the correct initial letter of a word, few seemed aware of the reason for the subsequent arrangement of the icons of the words that started with that letter. In practice they did not need to know this when there was only one screen of icons for a given letter. Their strategy to find a word was to scan the whole screen of icons looking first at the pictures and if this strategy failed, then to examine the words. The problems arose when there were more than one screen of words and icons e.g. One of the words to find was 'window'. There were several screens of 'w'

words and although a group looked at two screens of 'w' words, they failed to find it. They decided to look for other words on the list and 'come back to it later'.

Such decisions meant that the group were no longer working in list order, however, they relied on memory to recall which words they had found and did not tick off on the card, nor write down the words as they found them. At first, they just searched for a word, clicked on the animation or a coloured word. Later, they started to click on boxes such as 'more words' and started to browse. Towards the end of the list, when they were searching for the words they had not been able to find previously, they became less careful and, possibly by accident, clicked on the icons of words that were not on the list. This led to further browsing 'off task' for some minutes, after which they returned to their list of words.

By such paths, they usually managed to find all the words and printed out their chosen screens. Some children printed a screen that they liked without seeing all that was available whilst others saw everything FIRST and then made their choice. However, in these latter cases, it was not clear whether the word printed out was really their favourite or just one that they knew they could find easily!

The teacher who had prepared this workcard, explained that she had used this CD because of the lack of other age-appropriate Topic material on CD. However, she felt unable to assess the effectiveness of the activity as unlike other tasks, she could not actually observe them working. She had prepared the workcard, based on the type of card normally used in her class and had checked that the words were indeed on the CD. The children's printouts would be used in their Topic book and fitted exactly with several of the requirements of English Nat. Cur. Key Stage 2. The children were learning to use an alphabetical index, navigate, browse and print out from a CD-ROM in an entertaining and enjoyable way. When asked, the children said that they preferred using the CD to looking up words in a print dictionary. Having used the CD, they had increased their range of skills of CD navigation.

School A used this CD for similar activities; for their pupils, the explanation of the words was secondary to the navigation of the CD. By contrast, it was used by the hearing impaired unit of school C as a means of explaining printed words in a clear way than a print dictionary i.e. visually. Pester (1993) states that..

> Many hearing impaired children make very good use of visual images. IT allows language to be presented through a more visual.....form, enabling it to be talked about, experimented with and manipulated.
> (Pester, 1993:9)

In this situation, the same CD was used as a meaningful dictionary and a way of improving the children's experience of language. In 1985, Wordweb, a picture dictionary that allowed users to browse and explore words, had been produced specifically for deaf pupils. Unfortunately, due to the high memory requirements of the graphics, the version for BBC computer was published on five discs! It was also very slow to use and although the graphics were acceptable at the time, they now appear clumsy, out-dated and the suite is rarely used. The Amazing Dictionary was perceived by staff as potentially filling a similar role. However, unlike Wordweb, the First Amazing Dictionary was not designed with deaf pupils in mind so there were a some 'sound-only' effects and explanations in 'words only' that were not helpful. One pupil was observed to look up 'cup' - which was described as 'a container'. Unfortunately, he did not understand the word 'container' and clicking on the picture only produced a sound effect which he could not hear! However, most of the words were explained using simple language with clear pictures and animations. Some of these animations were particularly useful such as those with 'cat' and 'dog'. In both cases, clicking on the picture of the animal starts a cycle of pictures of other cats or dogs. Although this is an enjoyable animation for children with 'normal' language development, it serves a more useful function for those with language difficulties. In visual terms only, it shows that 'dog' can be used for one particular animal but it can also be applied to a whole group of similar animals and that dogs can be different shapes and sizes...but they are all dogs. Deaf children do not always understand this double use of the word 'dog' as discussed by Webster (1989).

The children in the unit used this CD-ROM in pairs with adult supervision. They showed great enjoyment in the use of the dictionary, especially the animations with accompanying sound effects, if they could hear them.

As these children had a more open brief, they soon spotted the icons for 'spelling' and games. All pupils in the school have weekly spellings to learn and are tested each Friday. Some of the unit children have spelling lists from their integration classes, others from the unit itself; the former are often phonically based - which causes problems for children who cannot hear the sounds clearly (or at all) and instead use a lip pattern and sign. Despite this, many actually enjoy this activity and are very keen to do well in the tests. The unit mainly uses its BBC B computer to run a spelling program that has been loaded with the school spelling lists so children can independently 'test themselves' in spare moments, breaktimes etc. The spelling test on the Amazing Dictionary was less successful than the children hoped. They were able to guess some words from the picture but when this failed or the word was spelt incorrectly, they could not access the 'clue' as this was the spoken word!

One pupil, discouraged by her inability to guess the word 'river' from a picture, asked to try the 'What's that Sound?' game. Staff were not keen for her to try this as she is profoundly deaf. However, her keenness to try was persuasive. The game consisted of a number of closed doors and pictures of animals. The purpose of the game was to click on a door, listen to the animal noise and then click the picture of the appropriate animal. To everyone's amazement, she was extremely good at this game and was tremendously proud of her achievement. The sounds were loud, simple and her choice was limited to the pictures; but from her audiogram, she should not have been able to differentiate them. Having observed this effect, staff subsequently used this aspect of the CD with other children, since it gave them a new insight into the child's empirical sound recognition. As the children perceived it as a game rather than a 'hearing test', they were relaxed about the activity and some interesting

results were obtained that staff felt could be used to assist them in enabling the children to access the National Curriculum.

6.4 Use of CD-ROMs for information with younger pupils (KS1/2)

Both schools A and B had initially used CD-ROM as an information source with their oldest pupils. They had subsequently introduced the use of the technology to their youngest pupils with the reading books and dictionary. It was the children in between for whom it appeared to be most difficult to obtain suitable CD-ROM titles. Although the children enjoyed both the reading books and dictionary, staff felt that they were capable of more challenging activities.

In class they were learning to select information from books as part of their Topic work. Staff were looking to CD-ROM technology to assist them in an age-appropriate manner. Building on children's success with software such as a dictionary, staff in all the schools with Key stage 2 children wanted to use CD-ROMs as an information source. All hoped for the availability of a simple children's encyclopaedia but none had found one, as yet. Instead, they had looked to more closely focused titles.

Schools A, B and C had all used Microsoft (MS) **Ancient Lands** linked to National Curriculum History Key Stage 2, study unit 4 or 6 (Ancient Greece or Egypt). Although designed for the American home-market, this title was considered by both staff and pupils to be one of the most successful. Often its use had been initiated by experience of the CD at home by either staff or pupils. By contrast, school A had purchased a CD-ROM on The Tudors which had been created around the requirements of the National Curriculum by a British educational publisher. Although the information and pictures were educationally sound, both staff and pupils did not feel it to be as exciting as Ancient Lands - it certainly lacked the visually stunning screens of the latter.

Regardless of the way that the CD title was chosen, for many pupils and their teachers, its use was probably one of their first experiences of multimedia technology. Staff took care in the preparation of activities. Since there is no standard screen layout, children were often given an initial activity to familiarise themselves with this aspect before they attempted to use the CD-ROM as a source of information. Teachers with multimedia computers at home usually took the CD-ROM home with them to familiarise themselves with it and to prepare activities. Several remarked that without this, they would not have felt so confident; neither did they feel that the project have been so successful. Those without such facilities at home, used the CD-ROM in school but the time available for such work was more restricted, as was their own experience of CD-ROMs in general.

A typical progression of activities was that used in school A with the CD-ROM **The Tudors**. The children were first allowed to browse the CD in groups of three to find out one fact about Tudor times. This sentence was written up on the class network computer in a Gothic-type font for the wall display. She had then created short workcards asking the children to find some simple information from the CD-ROM. The record of this achievement was to print out the appropriate picture which was again used in the wall display. The venture had been successful since all the children managed to find the information required. However, the teacher felt that this had been mainly due to the fact that the tasks were short, simple and written to the CD-ROM.

Pupils using **Ancient Lands** had generally used it as a source of pictures and printed out a chosen screen as a record of their work. In part this is because it is not possible to print text alone from this CD-ROM but it may also be due to the organisation of the information which makes searching for particular facts more difficult than might be expected. A group of pupils (in school C) were observed using this CD-ROM to find some facts about food in ancient Egypt. Their teacher had prepared a simple workcard, typical of the type used with this age of child and had checked that screens

showing that information were on the CD. However, when the children came to use it, they discovered that the subject areas started with a general screen on the Ancient World, or one of the ancient lands and information on specific areas was a subset of this. e.g. although they had chosen Egypt, when they subsequently clicked on the Fishing and Farming button, a screen appeared about this subject - but in Ancient Greece! However, on this screen was a button marked Nile Farming - which took them to a screen of information about farming in Egypt. As a result of this unusual screen linkage, the children found themselves repeatedly cycling through the same screens to find the button they had missed. They tried using the alphabetical index of the CD-ROM but found this to be very limited.

When each screen opened, there was a spoken commentary which was often very different from the text on the screen. In fact, the children seemed to listen to this rather than read the text, perhaps they assumed it was the same? When the group included a hearing impaired child, he tried to use the text to clarify the commentary and couldn't! - because the two were quite different! Perhaps because this child relied on reading the text more than the hearing members of the group, he actually found more information and subject buttons than the hearing children, who relied to a great extent on sound.

However, when the group did discover the information they needed, he was much slower at composing and writing his sentence in his workbook. Due to this, he often missed the start of the next search and spent time trying to understand what they were doing, and why. The researcher was surprised to see that these children did not copy out the text from the screen, as is common with young children using books, but made up their own sentences. These were quite revealing and showed where the child had only partly understood the text. The only child who did copy text verbatim was one with learning and reading difficulties. The other two children in his group were very supportive of this child; they read aloud the text on each screen with him. However, he remained a passive observer of the CD-ROM and did not want, nor was

offered, control of the mouse. Although he appeared to enjoy the pictures and sounds, it was difficult it assess how much of this was meaningful to him, although he expressed pleasure at the experience.

Similar problems of navigation occurred with a group of year 4 pupils using **MS Oceans** in school B. This is again a home-market product, designed for adults to browse rather than as a serious information source. Like other titles in the Microsoft Explorer series, the screens are visually appealing and there is an ambient noise of the sea. A new feature is the appearance of brightly coloured fish that 'swim' randomly across the screens. However, in their review of this title, *PC Pro* (1996, vol24) stated ...

> ...by deciding to cover every aspect of the sea,..... it's only able to deal with each theme in broad brushstrokes, which makes the CD patchy and unsatisfying most of the time....with other titles in the Exploration series the focus was tight enough to allow some fairly in-depth content. (but)... Oceans is paddling in the shallow end.
>
> (PC Pro,1996, 24:208)

The children were using this CD-ROM as part of their Topic on Weather. There were screens giving information on cloud formation, but finding them was not straightforward since the screens required had catchy, but unexpected, titles such as 'Storm at Sea'; like Ancient Lands, the alphabetical index was too limited for effective searching.

Having discovered this navigation problem for herself, the class teacher had provided a simple worksheet for her pupils that gave clear instructions on how to find the screen needed. Once this was located, they were asked to write down the names of the clouds shown. Although she had demonstrated the use of the CD-ROM to the children first, the information was organised in such an unexpected way that the one small mistake she had made in the instructions meant that the children could not locate the required screen. When this first occurred, the group tried clicking on various buttons that they thought might be helpful -and found screens about quite unrelated subjects! With help from the researcher, this mistake was corrected but it

was still possible for a group to miss one instruction from the list. This led to some groups browsing around in the CD-ROM and discovering screens on subjects, such as sharks, that they found interesting before returning to the original task.

Once the children had found the correct screen, they set about the prescribed task. There was much information on this screen for the children to digest. The names of the different types of clouds, such as cumulo-nimbus, were clearly shown on the screen. However, the researcher was surprised to see that the children actually wrote down words such as 'rain clouds', 'sun clouds' - which did not appear anywhere in the text. When this occurred with the next group observed, the researcher asked the children about these names. They pointed to the pictures and explained that one showed 'clouds with rain' and another 'clouds with sun'. The labels underneath giving the formal names of the cloud formations had been ignored.

By carefully observing subsequent groups, the researcher noticed that they appeared to scan the pictures, click on buttons, but did not read the text; again, they wrote similar descriptors of the pictures as their answers. If the computer had been in the classroom, the teacher may well have spotted the mistake in the worksheet but until the children showed her their written work, or she had time to sit with a group, she might not have appreciated their mis-interpretation of her instructions.

The children considered this to be an exciting CD-ROM but it was difficult to tell what they had learnt from the experience. Perhaps to answer this concern, the CD-ROM on The Tudors had been provided with a separate quiz to test the children's recall of information on the main part of the CD. Unfortunately, it appeared to have been added to the CD-ROM as an afterthought and almost no information on its operation was provided in the accompanying notes. After some experimentation, the children had managed to get it to run with some success, although sometimes it crashed for no apparent reason. The children used this quiz in their groups of three and were informally keeping a tally of their results. The quiz consisted of a question at a time

appearing on the screen with three possible answers. This engendered a surprising amount of lively, and often informed, discussion in order to select an answer. There was immediate feedback on whether the answer was correct, or not, but no opportunity to go to the page on the CD-ROM to discover the answer or learn more. The children were able to operate the program easily and appeared to enjoy the activity; some had even discovered how to reload it for themselves when it crashed but the main outcome of the experience was that they were devising a simple quiz of their own using the wordprocessor on the class network computer!

6.5 Use of CD-ROMs for information with upper junior pupils

In the survey, it was noticeable that many schools placed their first CD-ROM system with the oldest pupils. Three of the case study schools had followed this pattern; the fourth (school C) only placed the machine with year 3 because this was the IT co-ordinator's class. However, even this was seen as a temporary measure since she was intending to change to year 6, taking the multimedia PC system with her, for the following academic year. By upper junior stage, pupils were familiar with alphabetic order (to more than the first letter), had been taught the indexing and organisational skills needed to access many more CDs; they also had improved reading and comprehension skills. When this was combined with familiarity with the chosen computer operating system, the pupils were favourably placed to make good use of CD-ROMs as sources of information. Groups of children were observed using a number of such CD-ROMs to enhance Topic work in several areas of the National Curriculum. However, the books and CD-ROMs, that the children used, were very different in character. The former were predominantly designed for use in education and slanted towards the requirement of the National Curriculum at a particular key stage, whilst almost all of the CD-ROMs were neither. Even when designed for education, the CD-ROMs, such as Anglo Saxons, were often aimed at Key Stage 3 and above with consequent reading/ interest level. Despite these difficulties, the schools recognised the potential of the technology and its ability to provide not just text and

pictures, but video and sound as well. The latter two media were sufficiently appealing to encourage them to persist with CD-ROMs that were less than ideal for this age group. There was also a belief that as CD-ROMs contained a vast amount of information, there would probably be something useful, if only you could find it! Just like the more traditional media, these older pupils tended to use two groups of CD-ROMs for information:-

Multimedia Encyclopaedias

Subject specific CD-ROM titles

The former offered limited information on a wide range of subjects, whilst the latter provided more in-depth information on a particular area of the National Curriculum being studied by the class.

6.5.1 Multimedia encyclopaedias

Schools A, B and C would have liked the pupils to be able to independently access a multimedia encyclopaedia; however, they had been unable to find anything that met their needs. They all possessed, and used, **Encarta** but found this required both adult supervision since the reading level was so high, and checking BEFORE use to ensure that the item required was present.

Even with modern data compression techniques, in order to include the video, sound clips etc. that enable the CD-ROM to offer enhanced facilities over the print version, some selection of subjects for inclusion is required. Until recently, many of the encyclopaedias were American, rather than European, in origin - with consequent effect on this selection.

Two pupils were observed searching for information on Elizabeth Garrett-Andersen, without success, in several CD-ROM encyclopaedias. Their task had been to find information on 'a person of their choice from Victorian Times'. Although the use of a

CD-ROM was not essential, it was the children's preferred source, especially when photographs, pictures etc. could be obtained for use in their Topic folders.

Initially the pupils used the alphabetical index and were faced with the problem of her double-barreled name. Having tried both G for Garrett and A for Andersen without success, they tried approaching the subject through the subject area icons, both Medicine and History. To their astonishment, their chosen person could not be found. They were convinced that this was because they were not looking in the right place since they felt sure that the CD-ROM contained information on ALL subjects. In fact, Elizabeth Garrett-Andersen was not included, perhaps because this was not the English version.

With help from the researcher, they looked in two more CD encyclopedias, also without success - but found her in a more tightly focused book in the library. Their faith in the CD-ROM had been shaken - until they failed to find her in the class print encyclopaedia either!

However, they were still faced with a problem since they wanted to include material from the CD-ROM in their folders. Their solution was browse through the alphabetical index of the CD-ROM until they recognised the name of a suitable person! This was an example where, like the children using Tudors, the work had been changed to fit the content of the CD-ROM - which is perhaps no different from the common practice of teachers to write workcards around a particular selection of Topic books. In their use of this CD, the pupils showed a knowledge and ability to use quite sophisticated organisational tools.

Although pupils in school B used Encarta, staff were unable to be on-hand to sort out problems with open-ended tasks; instead they used worksheets whose outcomes had been checked in advance. They also used adult help when available. Pupils were observed using Encarta to find the date shown beside a number of people and events

that were to be found on the Time Line. They were assisted in this by an upper secondary pupil. Although the events and people were written in words on the workcard, the children used the picture icons to search for them. This strikes an interesting parallel with the younger children who searched the dictionary using the icons in preference to the words.

This strategy worked well to find the date of the invention of the camera (shown by an easily recognisable picture of an old camera) but was not so successful to locate Leonardo da Vinci - although many adults may have recognised the icon which showed the 'usual' portrait of him as an old man.

When the educational use of the technology was in its infancy, Marshall (1991) discussed ways in which secondary pupils were able to 'copy' text to the Clipboard and then use a wordprocessor to re-work this into their projects. Perhaps in the light of experience, Disney (1996) cautioned against the wholesale copying of chunks of text from multimedia encyclopaedias into homework and/or GCSE projects by secondary pupils. By contrast, the primary pupils observed did not attempt to do this. Instead they hand-wrote the information, usually a few sentences, into notebooks for either word-processing on another machine or handwriting into full text. However, unlike secondary schools, all the CD-ROM systems were stand-alones. Time on them was limited, and was for the use of CD-ROMs, not word-processing. Transferring the text to disc was rarely an option of the CD-ROMs used and, although possible, it required greater understanding of the operating system than perhaps can be expected at Key Stage 2.

Although the ability to collect text for reworking was perceived as an advantage of CD-ROMs for secondary pupils, the text was often the least helpful of the media for primary children. In McDevitt (1994) the researcher quoted an example of pupils who had printed the text from an encyclopaedia. They had obtained five close-typed pages of text on their chosen subject and although very impressed with the length of the

result, were unable to find the 'leaf ' of information they needed from the 'forest' they had printed out. During the current study, although pupils had printed pictures from encyclopaedias, they had not printed text, preferring to use workbooks to hand write selected information.

6.5.2 Subject specific CD-ROM titles

As with reference books, schools also perceived a need for more tightly focused CD-ROMs. In the absence of CD-ROMs created for the National Curriculum at Key Stage 2, schools used a variety of CD-ROMs that were originally designed for home use. Using their wider background knowledge, these older pupils were better able to cope with the non-standard ways in which the information was grouped. They usually used the multimedia system in pairs and were able to discuss such problems and make joint decisions. Like the younger children, they still looked first to the videos and pictures, then clicked on sounds when available, in preference to reading the text. Where pages had a spoken commentary, their notes tended to be based on this commentary rather than the written text.

As a bridge to the use of text in their word-processing, year 6 pupils in School A used **Nile Discovery**. This is a CD-ROM that simulates a falucca journey up the Nile from source to the sea. Information is collected by taking photographs, videos and consulting information screens from the sights (and sites) along the banks which can be sent to a decorative screen 'notebook'. The notebook includes a wordprocessor to add, adapt and re-work text. It is also very simple to return to the journey. This CD-ROM was produced by the Discovery Channel and contains much high quality video, pictures and sounds as well as text of suitable reading level, but was designed for home use. From previous observations of the way that text was used by primary pupils, this CD-ROM had been purchased in America by the researcher, mainly for the notebook.

During discussions with school A concerning sources of suitable material on CD-ROM about ancient Egypt, she offered this title on loan. However, it was far from clear whether the pupils would be able to navigate this CD-ROM, would find it interesting, or would be able to make use of the notebook. Observations were made of the children's first attempts to use the CD-ROM and again later when it had been used, along with Ancient Lands, as part of work on Ancient Egypt for National Curriculum Key Stage 2 History Study Unit 6. Like the pupils in school B and C, Ancient Lands had mainly been used for the high quality graphics.

The researcher noticed that although the CD-ROM was being used on the newest, and most powerful of the schools multimedia computers, it really needed a better video card (such as the researcher uses at home) to display the films to their best advantage. The pupils were not aware of this and found the idea of the CD-ROM very interesting.

They quickly mastered the method of sending photographs to the notebook. The children treated the simulation like a school visit, took photographs and then added captions and simple text to the pictures e.g. 'We have discovered many wonderful things.....'

The initial trial predated the Topic by some months. At that stage, they knew very little about the geography or history of Egypt so they tended to collect pictures on the animals. One group 'wandered' into a village and became interested in the screens about the Coptic church, taking photographs and videos for the notebook and listening carefully to the commentaries. Perhaps through lack of knowledge, when one group 'discovered' a temple, they quickly became bored with it and returned to the crocodiles on the river.

During their use of the CD-ROM, the children had discovered a number of games that were located at one of the sites. Perhaps because it was produced by an 'education'

TV channel, these games were designed as tests of logic, memory and understanding of concepts of weight etc. rather than joystick skill. The children said that they liked this part best on the CD-ROM and did not make a distinction between the journey which was of real places with actual photos, video etc. and the games that were pure invention.

6.6 Specialist uses of CD-ROMs

As well as providing information for the pupils, teachers can gain valuable insight into their pupils learning development by observing the way that they use CD-ROMs, and the results they obtain. With the enhanced pupil/adult ratio, the unit staff were able to make greater use of this aspect of the technology than their mainstream colleagues. As explained earlier in the chapter, staff in the unit of school C were able to obtain valuable, albeit empirical, information on the pupils understanding of sounds, that could not be obtained by formal audiological testing.This knowledge has been subsequently used in the planning of individual education programs for these pupils.

6.6.1 Use of CD-ROMs to develop problem solving skills

Since many school problem-solving tasks are language-based, deaf pupils are often unable to show their ability in this area. Part of the researcher's contribution to Hearing IT, published by NCET (1990) showed examples of how LOGO, operated via concept keyboard, was used, in the unit of school D, to provide problem-solving activities that did depend not on language. Since the use of LOGO was no longer included in the National Curriculum, staff had tried to find alternative opportunities for their pupils.

They discovered that use of the CD-ROM **A Silly Noisy House** went some way towards filling this gap. This CD-ROM allows children to explore a house and activate many effects, some of which are only activated by several actions in a particular

order. There are no words or spoken instructions so the deaf pupils were at no disadvantage compared to their hearing peers. In the NCET 1995 Guide to CD-ROMs, mention is made of the songs and rhymes on this title. Interestingly, they were not 'found' by these children, probably because most would not have heard them. Some of the children could recognise the simpler sounds that were additional to some visual effects, and greatly enjoyed them, but most concentrated on the visual rewards.

At first children were allowed to 'explore the house' but the CD-ROM was also used for more specific tasks linked to the pre-Dearing English National Curriculum Key Stage 1 Speaking and Listening. Using the multimedia computer was one of the circus of activities in the class, and used by one or at most two children at a time. The children became very excited by this CD-ROM and started to communicate their finds with others, using whatever communication method suited both parties.

One child in particular seemed to be especially successful with the CD-ROM. He is a child who despite much effort, still has almost no communication. At the time, he was undergoing a series of test and has since been diagnosed as deaf and autistic. As shown in Appendix 6, computer-based activities have been used with him over a period of years to encourage interaction but he had not used anything like Silly Noisy House before. Unlike some CDs, the colours used are not bright so he did not become overwhelmed by the visual stimulation. He has an ability to remember sequences and repeat them, which proved advantageous. The places he visited were different from those chosen by other children but correspond with his own favourite 'safe' places in the classroom. e.g. On times, he will wrap himself up in his coat, on its peg, and stay in the dark until he feels able to return to the main classroom. Edelson (1995) reports the theory that some autistic individuals, who cannot process or attend to the environment as a whole because it may become overwhelming, simplify their life by focussing on only a small part of it. Using the CD-ROM, he went straight to the coat cupboard in the house - where he discovered that he could move

the coats and find a skeleton - at which he showed the nearest he gets to a smile. He often returned to this cupboard on subsequent uses of the CD-ROM.

He also discovered how to generate and reveal a dream in the bedroom, and that the dreams were rarely the same. Other children noticed these effects and wanted to know how he did it! There are a few children in the unit that he can tolerate, so situations were devised where he worked with one of these children using the CD-ROM. Staff had noticed that when he used it on his own, he always activated the dream. When using it with another child he still needed the same things to happen. If the other child was given control of the mouse, he started to communicate with them, in gesture and sound, to get them to make the program do what he wanted. For John, this was a major step.

The children also tried using the **Amanda Stories.** These are simple tales related in a sequence of line drawings. Some are longer than others but John was able to remember the way to navigate event the most complex. How much he understood was impossible to tell due to his lack of communication but the idea of these stories led to his completion of a series of computer line drawings telling the story of Jack and the Beanstalk. These drawings were linked into a slide show by his teacher which he often chose to view. This also represented a breakthough for this pupil. The use of multimedia technology has helped to show that John has a communication, rather than a learning, problem and has also provided a media which it is hoped to use to further his development of communication.

6.6.2 Use of CD-ROMs to develop literacy skills

Many of the children in the unit of school A have literacy difficulties and were using some specialized CDs as well as the titles such as the Living books enjoyed by others in the school. Children who were using multisensory approach to spelling were observed using **Speaking Starspell.** This is a CD-ROM version of popular spelling

software that uses phonically-based lists. although similar in screen presentation to the traditional version, the CD offers digitised speech to 'speak' the word. Although the children appeared to enjoy the software, which offered them independent structured practice of this skill, staff felt that it was too early to judge whether it enhanced learning.

Summary

Although there were differences between the way in which the CD-ROMs were used by the four schools, a broad pattern of use emerged. Pupils were first introduced to the technology using a simple, age appropriate CD-ROM title. This would later be followed by structured activities to develop age appropriate navigation and search skills. In this way it was hoped that by the upper junior level, pupils would be able to use CD-ROMs as an alternative source of information. Even at the introductory stages, the activities were incorporated into the requirements of the National Curriculum whenever possible. This summary has been organised under the same headings as the research questions.

How were pupils introduced to the use of CD-ROM technology?

All four schools engaged in these introductory activities; although schools A and B superficially appeared experienced users of the technology, there were parts of those schools for whom it was new. Just as in the survey schools, multimedia reading books were a popular source of these introductory experiences. They were immediately appealing to children of a wide age range whilst they learnt to use the pointing device and simple navigation of pages. They also experienced some possibilities of additional media such as animation and recorded sound; indeed the reading activity soon became subsumed to the exploration of the pictures. It was noticeable that even 'experienced users', who were able to predict the effects, did not appear to tire of them. The very visual nature of these effects made them accessible to children with hearing impairment. The animated explanations of vocabulary, found in certain titles,

were found of particular merit. However, these helpful features were less noticeable in more recently published titles where the use of recorded speech predominated.

Older pupils were observed being introduced to the technology using alternative packages that were also easy to use and provided immediate success with minimal supervision. These older learners were already able to operate a mouse pointer but used the packages to acquire simple navigation skills. Activities were normally integrated into the National Curriculum work of the class. As before, pupils used the computer in small groups but were provided with written work cards or navigation sheets. Although these packages were some of the most visually stunning, they were found to have features, such as poor indexing or print facilities, that made them less suitable for more serious use than anticipated.

How did they learn the information-finding skills to use a CD-ROM effectively?

Schools perceived the main purpose of CD-ROMs technology as providing access to information and that pupils needed to learn the strategies to access that information. This was achieved through the use of age-appropriate information CD-ROMs used with structured search tasks, linked to the traditional media search skills that were being taught within the National Curriculum. Such activities revealed major differences between the reference books and CD-ROM sin common use in the schools. The books were usually designed for use in British education, often for the National Curriculum, organised and indexed using a standard method; the CD-ROMs were neither. Pupils were taught standardised strategies that could be used to successfully access to information in most books. However, they could not be used as successfully with the commercial CD-ROMs used in the schools due to their idiosyncratic organisation and indexing; instead, navigation and search strategies were taught for each title. Greater use was made of pictures or icons as part of the search process by CD-ROM information sources. This combination was helpful to pupils with impaired language skills. It was noticeable that given the choice, almost all pupils tended to use the pictures in preference to words throughout the age

range. However, the combination of incorrect pupils' assumptions concerning the information on a CD-ROM and the reduced information per screen resulting from the use of pictures/icons could act as a barrier to successful searching. When pupils did not find the information required, they devised alternative methods of achieving their goal. However, success was variable as the methods employed were both individual and usually non-systematic.

How did the use of CD-ROMs change through the primary age range?

Younger pupils used CD-ROM titles that provided age-appropriate reading or problem solving activities to reinforce known skills. By using the CD-ROMs, the pupils learnt to control the mouse, the effect of clicking on objects; navigation was usually restricted to turning the page.

Only when they had mastered simple ordering, such as alphabetic order, were they introduced to the use of CD-ROMs for information collection. In part, this was due to the perceived need for information finding skills to be taught in a structured way but also to the paucity, at the time, of age-appropriate information CD-ROMs.

Older pupils tended to use the CD-ROMs almost exclusively as an alternative source of information. However, some of the most visually exciting, media-rich, titles proved most difficult to access for prescribed information for they were usually developed for the home market and designed for browsing rather than serious study.

Both pupils and staff were aware that one CD-ROM could contain much more information than one book; CD-ROM encyclopaedias containing as much information as in many printed volumes. Until experience showed differently, many pupils additionally assumed that ALL the known information on every subject was present on these CD-ROM encyclopaedias. Pupils stated a preference for the CD-ROM encyclopaedias and enjoyment of the additional media therein, but they were often disappointed by the results of specific searches. At least in part, this was due to the

American origin as well as the intended audience (home-market) of the titles being used.

Many of the same CD-ROMs were used with pupils with special needs but the greater adult/pupil ratio enabled activities to be more closely focused towards meeting individual needs. Both teachers and pupils were enthusiastic users of the technology; even those who could not access all the media, were excited by it. Since none of the titles were designed for use by deaf pupils, it was serendipitous to what extent the visual media compensated for, or explained, incompletely understood spoken or written text. Teachers were observed to seize any opportunties that arose and make creative use of what was commercially available. Thus New Kid on the Block and parts of the First Amazing Dictionary were used to develop pupils understanding of language, whilst the sound games of the same dictionary provided empirical audiological information.

What changes have resulted from the use of CD-ROMs in primary schools?

Although pupils always expressed a preference for CD-ROMs over books, the actual use of the CD-ROMs appeared to have less effect than might have been expected. Younger pupils' group reading activities, though greatly enjoyed, appeared to the researcher, analogous to the group reading activities using taped stories that were previously used. Similarly, information CD-ROMs offered additional media to books but were used in much the same way, except that there was only one copy. However, differences were.noticed. i.e. Although schools might have only one copy of a particular reference book, they did not generally expect all pupils to use it. When a group of pupils were directed to obtain information on a subject from traditional sources, they generally worked alone or in pairs, each using a different book on the same subject; if they all needed the same book, they used it in turn. When using CD-ROMs, the whole group used it,at the same time, perhaps because the information was displayed on a screen that could be seen by all.

The information was recorded and subsequently used in the same way as when traditional sources were used. Notes were taken by hand from which a 'best copy' would be produced either by hand or wordprocessed on another computer. Primary pupils were not observed to cut and paste information to disk or the Clipboard. The print facility offered by some CD-ROM titles was used predominantly for pictures. In practice, the 'picture' was in reality the entire screen; such young pupils had neither the additional software, nor perhaps the time or expertise, for picture editing. This ability to obtain an exact copy of a picture from a CD-ROM was the most marked difference in result between traditional and CD-ROM information sources. Pupils using books either traced or copied pictures by hand; those using CD-ROMs obtained (often full colour) replicas.

Pupils were guided to information collection using workcards/sheets that were very similar to those used for books; plus the addition of information on the navigation of the particular CD-ROM. Whatever the information source, the researcher noticed that pupils often used pictures to assist them in their searches. However, when pupils used CD-ROMs there was an interesting difference between the primary source of information used by teachers and pupils; teachers used the text but pupils used the 'spoken' commentaries. Since the latter was rarely identical with the text displayed, it did not assist the poor reader. However, this difference proved beneficial to a hearing impaired pupil who could read but not access the speech. For once, he found the correct answers in advance of his hearing peers.

Other aspects of the ways in which CD-ROMs were used and the changes they produced were discussed in previous chapters. All of these findings are brought together in the next, and concluding chapter.

Chapter 7

Conclusions

Discussion

In the introduction to this document, the researcher set out to answer the following research questions:-

How was CD-ROM technology being used in mainstream primary schools?

Which CD-ROMs were being used, and for what purposes?

What changes have resulted from the use of CD-ROMs in primary schools?

This final chapter is organised under these same broad headings and the conclusions and propositions that are made in this section, derive from an interpretation of the observations made in the case study. However, the validity of such interpretations have been judged in the wider context of the findings from the postal survey as well as reference to the literature. However, before embarking on these matters, it may be helpful to consider the typicality of the case study schools within the context of the postal survey.

7.1 How typical were the case study schools?

Although this factor was not included in the criteria used to select the case study schools, there appear to be surprisingly similarities between the two groups of schools. There was similar spread of numbers of CD-ROM systems in the schools and also the siting and age range of pupils who accessed those machines. Very similar titles, for similar age groups, were used by the schools to introduce their pupils to the technology. Similar remarks were expressed by staff concerning such matters as printing of information, availability of suitable multimedia material for younger pupils as well as for the Archimedes platform.

The one area where the case study schools were likely to be atypical of the postal survey schools was in the proportion of the sample that included specialist units within the schools. The case study schools were deliberately chosen to include such

units in order for detailed observations to be made of the impact of the technology for mainstream pupils and, in addition, the effect these uses had for pupils with special needs. The purpose of the postal survey was to obtain a broad sweep of information on the uses of CD-ROMs with mainstream pupils and thereby assess the typicality of the cases study observations. Thus, no questions were included in that survey concerning specialist units. Where conclusions are made concerning the uses of CD-ROMs within the specialist units, these are only made in comparison and contrast to that of mainstream classes.

7.2 How was CD-ROM technology being used in mainstream primary schools?

7.2.1 How and why was the use of CD-ROM technology initiated in the schools?

The technology had been introduced to most schools as a result of a government initiative. Thus for many of the schools who responded to the survey, as well as the case study schools, there was only one computer system capable of using CD-ROM technology in the school. The introduction of this innovation, by those government initiatives, used a very similar cascade model to that used for the introduction of the first microcomputers some ten years previously. As before, the initiative was technology-led, not curriculum-led. The researcher found it unsurprising that many of the same problems, commented upon by Russell (1988 and 1995), Crook (1994), were echoed in the postal survey responses and observations in schools. The limited time allocated for staff training by the initiative necessitated a focus on management of the system rather than how the CD-ROMs could be used to enrich the curriculum. Schools were expected to discover these for themselves. Before an IT co-ordinator could cascade this knowledge to others in the staff, they must first have acquired a level of competence and confidence in this new technology and its curriculum applications. The attitude of the headteacher appears crucial since they could allocate resources, both in terms of time and finance, to make this possible. If general staff training was to be provided, then this had to be perceived to be of importance and built into school INSET plans, possibly at the expense of another aspect of the

curriculum. Schools who did not perceive curriculum uses for this new technology would be unlikely to persevere with it and, like school C, use the system a standard class computer, with familiar curriculum uses. The researcher found tremendous differences in achievement between schools where the IT co-ordinator was heavily supported by the headteacher (or was the headteacher) and those where they were not.

The researcher considers that it should be noted that specialist units, attached to mainstream schools, were not eligible to bid for any of the government CD-ROM initiatives. Where unit staff perceived a need for such equipment, it was obtained by whatever funding method was possible for that unit. School C's unit used a system that had been provided by the LEA for staff administration and school D's unit used a loan machine whilst they raised funds and approached charities. Only school A, with a unit initiated and funded by the school, had a system that had been purchased by that school expressly for use by the unit.

7.2.2 What equipment (hardware and software) was available

The CD-ROM systems provided by the government initiatives included a package of CD-ROM titles, selected by NCET, but no printer. CD-ROMs were not usually provided with systems that schools that had purchased themselves, or, like schools C and D, had been provided by alternative LEA schemes. Even where schools had software, it might not meet their needs. A number of infant schools reported the unsuitability of most of the CD-ROM titles for their pupils. A lack of software did not present a financial problem for schools, such as school B, who already had software from a DfE initiative but did present major difficulties for schools, such as school C, who had neither the CD-ROMs or funding. Once again, the priority placed on the use of the technology by the headteacher was paramount. Schools A and B both allocated funds for the on-going purchase of both hardware and software. When this was not available, staff obtained CD-ROM on loan, often from home. Where funding was

available but limited, as in the unit to school C, titles were mainly purchased after the successful trial of a loaned titled.

Although almost a third of the postal survey schools were operating their systems without a printer, the need for this equipment was frequently noted. Primary children have not been observed to use the Clipboard, or copy to disc, and the lack of a printer appeared to influence schools in their choice of CD-ROMs to use with pupils. Schools without printers tended to make greater use of titles, such as the reading books, where printing was not needed.

Most schools who had provided a printer, used it for both text and pictures. However, many schools in the survey expressed disappointment with the quality of printouts they obtained. From observations, the researcher found the same views expressed and that staff expected the printouts to be of the same quality as the screen image. The disappointment in print quality would not have been helped by the rudimentary print facilities of some of the older CD-ROMs included in the package but also pointed to a lack of understanding, or communication of information, on this aspect of IT. Another cause for dissatisfaction was that text is generally printed out, directly from the CD-ROM, in standard 80 character per line typeface. Not only is this usually different from its appearance on screen but is also different from the style of print commonly offered to primary pupils. CD-ROMs that appeared to print out in 'large' text, generally achieved this by providing a graphical printout of everything on the screen - text, pictures, captions.

7.2.3 How, and by whom, were decisions made concerning purchase and use of equipment?

Schools were faced with decisions concerning the use to be made of their CD-ROM system, the siting of it within the school, the age range of pupils who would have access to it, as well as decisions concerning any additions, both hardware and software, that would be needed. Although the headteacher was ultimately responsible

for the way in which the new system was used, responsibility was devolved to the IT co-ordinator who made decisions based upon the school IT policy and staff development plan. The IT co-ordinator of school C had used a 'windfall' LEA initiative to obtain the CD-ROM system but retained it in her classroom as her staff development plan for that year concentrated on the implementation of the National Curriculum by all staff. Her additional expertise enabled her to achieve this with her own class and also develop her own expertise with CD-ROM technology which would enable her to expand its use within the school at a later date. Her decision was also influenced by her lack of CD-ROM software or additional funding. This contrasts with schools, such as A, B and the unit to D, where the heads were also IT co-ordinators. Their high priority for IT ensured that staff were not only implementing the National Curriculum but had the confidence and competence in IT to introduce this new technology into their delivery of the curriculum. The case study confirms the findings of Southworth (1993) concerning the influence that a headteacher can bring to bear on their staff both at the policy making level and practical level. Both headteachers of schools A and B were observed working with pupils and staff to implement the use of the technology as well as leading the writing and revising of school IT policies. Only these two schools perceived that both hardware and software would need upgrades and additions. Both headteachers had set funds aside for on-going purchasing and were actively seeking advice on suitable titles for use within their schools. Ironically, this policy resulted in school B obtaining much free CD-ROM material!

Since there were virtually no CD-ROMs that had been developed, either commercially or by government initiative, to meet the requirements of the National Curriculum, schools were using commercial CD-ROMs. Many of these had been developed for the American home market. This cultural difference caused some problems. Interestingly teachers, but not pupils, commented on the accents on the Living Books but both groups were frustrated by selection of items in the encyclopaedias. Some of these problems may have been resolved by the subsequent publication of 'British' versions

of the most popular titles. e.g. Encarta and Living Books. However, these were not observed in use as they were published after the period of the observations.

The need for schools to select their own CD-ROM titles from a large commercial market caused difficulty for those, like the IT co-ordinator of school D, who had always relied in the past on LEA recommendations. With a small budget and no personal experience of the technology, she felt ill equipped to make CD-ROM purchasing decisions and unprepared for the inevitability of making mistakes. Although assistance with selection could be obtained from publications, such as the *CD-ROM titles review* (NCET, 1995) this was very different from her past experience of a very limited LEA list of content-free software, often obtained from that LEA at reduced cost.

By the time of the observations, many staff and pupils also had CD-ROM computers at home. All of the case study schools made use of CD-ROMs loaned by staff and/or pupils and benefited from their home experiences. The titles used by the unit of school C were obtained by this 'try before buy' method and staff considered that it enabled them to make the best use of their very limited funds. However, they had a high percentage of staff both having CD-ROM systems at home plus a willingness to lend their CD-ROMs for use by pupils.

7.2.4 Where and by whom was the technology used?

Both from observations and the postal survey returns, the CD-ROM systems were usually used by groups of two or three pupils. McDevitt (1994) reported that schools A and B were using groups of four when they introduced the technology but both had reduced the group size, in the light of experience, by the start of the current research. Observation confirms this as the most practical number since in larger groups, the pupils on the periphery rapidly became bored and the group was effectively reduced to two or three.

Within the unit situation, pupils used the CD-ROM systems individually or in pairs, frequently with adult supervision. This was possible because of the much higher adult/pupil ratio of the units and also the individualised nature of their use of the CD-ROMs.

In both survey and case study, most schools decided to operate the system either within classroom or in a central resource area, or library. Observations indicate that the architecture of the school may have influenced this decision. e.g. The arrangement of the systems in schools A and B had been set when they obtained their first systems (McDevitt 1993). Although both schools wished the system to be used by as many pupils as possible, school A has no suitable central area whereas school B's sloping site made transport of the system between classrooms impractical. However, another influence on school B may have been the change in educational culture, at the time, which encouraged competition between schools. Parents had paid for school B's first system and the headteacher felt that parents should not only see what they had bought but also see it being used by their pupils. The arrival of subsequent systems demonstrated the school's success in national competitions as well as the Local Authority's confidence in their competent use of IT. Whatever the advantages or disadvantages of this method of operation of the CD-ROM systems, the multimedia systems create a considerable impact as you enter the school. Although school A actually had more systems in use, they were far less obvious to visitors, such as prospective parents. However, this may be of less importance in a more isolated village school without immediate competition for pupils from other schools.

Wherever the system was sited, there were inherent advantages and disadvantages. The researcher felt that the major advantage of putting a system in a central area was that it could be accessed by more pupils, either informally or via a timetable, than if it was located in one classroom. Unlike the other case study schools, pupils in school B were timetabled for use of the CD-ROM systems. This method had been started when the technology was first introduced. As more systems were obtained, this timetable

was expanded to cover, eventually, the whole school. The headteacher considered that this system not only ensured maximum use of the systems but that each child could be confident of their allocation of time using the technology. Pupils were also aware that this time was limited and they must make efficient use of each opportunity. This was also the only school where the CD-ROM systems were used without adult supervision. The success of this policy was perhaps due to the school's ethos of personal discipline and responsibility; it was certainly most impressive that very few pupils became distracted even when there were four CD-ROM systems operating simultaneously in the central area.

However, these advantages were counterbalanced by the fact that teachers had no way of observing or monitoring pupil's use of the CD-ROMs. Although staff could ascertain from completed worksheets or printouts that children had accessed the expected screens, they had no means of making qualitative judgements concerning the children's use of the CD-ROMs. Staff could easily remain unaware of problems such as those of navigation or worksheet directions, especially when children were given open-ended tasks. Even when children were asked to find very specific information, such difficulties could easily remain unknown to staff until the work was marked or used as the basis of a subsequent lesson.

A practical difficulty that arose with the youngest children in school B was that some were unable to judge when their time had elapsed. Pupils who could not tell the time relied on the arrival of the next group to know when to stop. The system broke down when neither group could tell the time! Once staff became aware of the problem, a simple stopclock was introduced; pupils started it when they arrived and stopped when the hand pointed to a marked number.

The researcher noticed that the youngest children had the greatest range of concentration spans. When pupils were operating the system within a classroom, staff

could observe their behaviour and transfer them to an alternative task. However, this was not possible when the system was operated in an unsupervised central area.

Another cause for pupils drifting off-task was when control of the mouse pointer remained with one or two members of the group. It was observed that the child who held the mouse, controlled the activity. If mouse control was regularly changed then the whole group remained involved in the decision-making process and interest was sustained by all. However, if a group contained one dominant member, that group effectively became a group of two. i.e. the mouse controller and an adjacent child who were actively engaged in discussions, whilst the rest of the group became bored observers. Some of the 'mouse dominators' were unaware of their actions, being totally absorbed in the activity. This inadvertent domination was not observed to occur in pairs where pupils were observed to remark to their dominant partner, "It's my turn NOW!"

Placing a multimedia system within the classroom did not remove all the inherent difficulties. Although it was much easier for staff to monitor what the pupils were actually doing with the CD-ROMs, albeit at a distance for much of their time, the system itself could provide a distraction to pupils. The monitor presented a changing sequence of colourful and potentially distracting images, which were augmented by speech and other sound effects. A common solution to the latter problem was to use headphones, often via a junction box, to enable only the group of users to enjoy the audio effects. Another potential source of disruption, to the class, was the noise made by the printer. As the DfE initiatives did not include a printer, schools often used a 'spare printer' - which was frequently of dot-matrix type and very noisy. This problem may well be transitional in nature as schools are now using inkjet/bubble jet printers. Not only are they much quieter but the quality of printout is much better.

Schools who decided to place their CD-ROM systems within the classroom, then faced a further decision; should it remain in one classroom where a small group could

obtain in-depth experience of the technology, or should it be moved to a number of different classes, using some form of rota? Both of these options were found in the case study and survey schools. Where the machine was kept in one class, this usually appeared to be the class taught by the IT co-ordinator, as in school C. However, if the potential of such in-depth experience were to be achieved, then both suitable material for the children was needed and the system should not have to double as the basic class computer. Where the multimedia system was also the class computer, observations imply that the introduction of the new technology is subsumed to the needs of the general IT curriculum. Another danger inherent in use of the system by one class is that other staff do not obtain experience of the technology and therefore do not perceive its possible uses for both themselves and their pupils. In a time of reducing budgets, it may be hard for schools to justify large expenditure on equipment that will only benefit a very few pupils.

The survey revealed a number of schools who placed their CD-ROM system on a trolley for use in a number of classrooms on a rota or choice basis. It was noticeable that the uses that these schools made of the system appeared to closely parallel those found by Russell (1988) when microcomputers were first introduced to schools. This time, multimedia reading books appeared to provide the type of easy to use, curriculum independent activity that could be fitted into a short access time. This may imply that this type of activity is an essential, and inevitable stage on the learning curve for any new technology. If this is true, then this need should be considered in the provision of software accompanying such initiatives and its use both accepted, and built into, the staff training provided. It was noticeable that many schools used a single multimedia reading book throughout the age range although they had been provided with other titles, in the same series, that would have been more appropriate for their older pupils.

As a school IT co-ordinator during the introduction of microcomputers into schools, the researcher had found it easy to persuade all staff to use the new equipment once,

for a simple activity; it was much more difficult to persuade them to a second, possibly more difficult curriculum-focused activity. It was noticeable from the survey that although a number of schools used a multimedia reading book with most classes, far fewer classes used the curriculum focused titles. In part this was due to the suitability of the particular CD-ROM material provided, as discussed in chapter 6. However, observations confirm the crucial role of the headteacher in spreading of the use of the technology in a given school found by Watson et al. (1993). Where the headteacher perceived it as important that classes should use the CD-ROMs, then staff found ways in which they could incorporate the CD-ROMs into their teaching. Making such changes was not always easy but the headteacher was able to influence more reluctant staff. When they perceived the need, the headteacher was able to assist less confident staff by working alongside them in class, as observed in school A, or helping to create worksheets and navigation helpsheets, as in school B.

This appears to be particularly important where the IT co-ordinator is not a senior manager of the school. Brown and Howlett (1994) considered the attitude of the headteacher towards computers and IT to be crucial. This view was borne out by the case study observations where there was a most marked contrast in the status, perceived value by staff and pupils, as well as funds made available for CD-ROM technology, in those schools where the headteacher was personally very interested in IT and placed a high value on its use. The researcher considered that it was not essential that the headteacher should also be the IT co-ordinator; the important factor was their very positive attitude towards IT. This exerted a powerful influence over staff and pupil attitudes which were in marked contrast to those of schools where the headteacher, having less personal interest and expertise, perceived IT as just one of a range of National Curriculum subjects to be overseen by a member of staff.

7.3 Which CD-ROMs were being used, and for what purposes?

The postal survey schools received a range of CD-ROMs with their system. Although the titles varied with the computer platform, the most popular titles were the reading books and large encyclopaedias, especially Encarta. These CD-ROMs were used across a wider age range than might have been anticipated. However, these titles met schools stated preferences for material that was easy to use and could be linked to the requirement of the national curriculum. In some ways they were interesting choices. Schools were critical of the American origin of many of the CD-ROMs, yet these most popular titles, with one exception, were American in origin. Although highly regarded, the more tightly focused CD-ROMs were less used. The pattern of use by a single year group may also imply that use was incorporated into the delivery of one area of the national curriculum. The least popular titles were those which could not be incorporated into the curriculum, required additional software or were difficult to navigate - especially the photo databases, which appeared to fit all three criteria!

The researcher was aware that this survey could only show the uses that schools were making of the technology at one point in time, when many were still in the process of introducing the technology to their pupils. The case study offered an opportunity to judge if, and how, those uses changed over a period of time. The same pattern of use was found in the case study schools at the start of the research, perhaps because they used the same criteria in judging a CD-ROM.

During the period of the research, the number and range of CD-ROM titles increased enormously. However, this was neither the result of parallel government initiative, nor commercial venture designed for use in British education. Instead, it was a phenomenon of the popularity of the technology in the home and leisure markets. Where schools made funds available, they were able to take advantage of this boom to obtain suitable material for use with their pupils. Where this was not possible, then they used whatever was to hand, either supplied with the system or brought from

home by staff or pupils. Again, there were stark differences between resources available to schools that bore little relation to their size, or general funding. Despite these difficulties, in both the survey and case study schools, a pattern emerged in the way CD-ROMs were used. There appeared to be three stages of use:

Stage 1. Introductory uses of CD-ROMs

Stage 2. Uses of CD-ROMs to develop searching skills

Stage 3. Curriculum focused use of CD-ROMs.

7.3.1 How were pupils introduced to the use of CD-ROM technology?

When schools first acquired the technology, the most frequently used CD-ROMs were either multimedia reading books or large encyclopaedias. The former were used by a wide age range, often wider than their intended audience, as a means of introducing the technology to a large number of staff and children in a short time. The latter, were perceived as an exciting source of information on a very wide range of subjects. Unfortunately, the particular examples of encyclopaedias available to schools in 1993/4, proved less useful to primary pupils than was anticipated. Having observed pupils using the material, and ascertained the reading age of the text, the researcher wished that she had included questions concerning the detailed use of these encyclopaedias in her postal survey. From later observations in the case study, as well as the researcher's main occupation, she found these encyclopaedias being mainly used by schools as resource of pictures, video and sounds that is used to augment age-appropriate text from printed books.

In different ways, both of these types of CD-ROMs could be used for short, introductory activities. The reading books were easy to load and easy for pupils to use independently. Alternatively, a confident teacher could locate a particular page, or set of pages in an encyclopaedia so that pupils in their own class, or that of a less-confident colleague, could learn to activate a video, sound effect or print a picture. Later, when they had built up a level of confidence, pupils, and staff, could learn to locate pages for themselves.

Towards the end of the period of the researcher's observations, alternative ways of introducing the technology to less confident staff were being used. In part, this required the presence of some confident staff within the school but was also made possible by the arrival of innovative, age-appropriate material, such as multimedia art programs or visually stunning information titles. As these titles were originally aimed at the home market, they were easy to operate and provided short, exciting experiences for beginners. Apparently 'reluctant' staff were prepared to introduce the use of the technology into their teaching where it was both easy to use and could be matched to a personal interest or could provide them with a way of delivering an otherwise 'difficult' aspect of the National Curriculum. Such possibilities were perceived by more confident staff who were committed to expanding the use of the technology in the school. The titles that were observed being used in this way were either part of the package supplied with the system or were brought from home by staff and/or pupils. Where this interchange of titles and experience between home and school was active, schools were able to make more efficient use of their funds since they could often try out, or at least canvas opinions, before purchasing new titles.

7.3.2 How did they learn the information-finding skills to use a CD-ROM effectively?

Although CD-ROMs can be used to store vast amounts of information, it remains inaccessible to users unless they can select the particular information they require from the rest. The need to teach search skills had been recognised when the technology was introduced to secondary pupils in earlier initiatives. NCET publications such as such as *Seek and you will find... fast* (Marshall, 1991) included suggestions for ways of developing these skills as well as worksheets to practise the techniques. However, these were aimed at pupils who were already trained in 'traditional' methods of searching for information in print-based sources and built on

these already mastered skills. In addition, traditionally-based search methods were successful because the CD-ROMs that were used at that time were very similar to print sources, being predominantly text and operating as a very long document. When the technology was extended to younger pupils, the problem required alternative solutions. Not only did the pupils lack experience of basic information finding skills but also the nature of many of the CD-ROMs themselves had changed.

Schools recognised the need to teach their pupils the skills needed to search an information CD-ROM and that these skills could only be built up over a period of time using structured activities of progressing complexity. Indeed some of the observed 'information finding' activities were designed as much to teach these skills as to obtain information. Although the English National Curriculum includes targets which could be expected to assist pupils in finding information from traditional print sources, the IT National Curriculum does not include guidance for teachers in the development of search skills for CD-ROM material. Teachers devised their structured activities on the search skills they themselves would use, based on experience of traditional sources and linked them to other literacy skills such as alphabetic order, use of an index etc. Pupils were usually provided with simple worksheets to complete that were very similar to those used for more traditional tasks. e.g. pupils who had learnt simple alphabetical ordering and dictionary skills, were asked to practise those skills using an age appropriate CD-ROM dictionary. However, the task of finding a list of words in a print dictionary and the CD-ROM version were not the same. The presentation of items as icons, having both pictures and words, provided additional complications as well as distractions for pupils. Perhaps because their attention was drawn first to the pictures rather than the words, pupils were sometimes unable to find the requisite item, especially where the words that began with a particular letter extended over more than one screen or a screen contained items with a mixture of initial letters. Pupils assumed that clicking on the required letter on the alphabet list showed **everything** that started with that letter, rather than just one of several pages. Where neither the worksheet nor the screen suggested looking on adjacent pages, some pupils were unable to find the words they needed and resorted to

random browsing of the pictures. This was a direct equivalent of a technique the researcher observed in children using books in the reference library where they flicked through books searching for a picture of the item they wanted.

These observations highlighted the difference between the adult search method, based on a formal word-based system, and those used by children, often based on graphics and unstructured browsing. The two groups were coming to a given CD-ROM from two quite different traditions, though neither group appeared aware of this fact.

Teachers had appraised and used each CD-ROM themselves and created the worksheets to provide what they hoped would be appropriate tasks and also provide help with navigation. However, most teachers considered that they had to do this within the time available to them, which was less than they would have liked. Unlike a book, they could not take the CD-ROM home with them to examine over an extended period of time, unless they happened to possess the necessary computer equipment. The researcher conjectured that this combination of haste and their established thought patterns in 'traditional' methods of obtaining information, based on books, caused them to look for, and use, what superficially appeared to be a traditional method of finding information on the CD-ROM and assume that this was the best, and perhaps only, search method. Teachers concentrated their attention on the words; they were not distracted by the presence of other media and did not expect their pupils to be different. Pictures were expected to support reading, not a distraction or an alternative to reading. This produced some interesting results for worksheets did not always 'work' in the anticipated way. As explained in chapter 4, a hearing impaired child in school C was more successful in finding the requested information than his hearing peers because he was unable to listen to the commentary and, like his teacher, read the text on screen. From the evidence of the completed worksheet, he had achieved more than other children as he had more correct answers to the questions. Within the educational culture of the time, this was a very positive experience for a child whose communication difficulties had accustomed him to being less successful than his peers. However, it did not

necessarily mean that he had learnt more from the experience of using the CD-ROM. Completion of the worksheet was expected to provide evidence of accurate reading, and assumed internalising, of a given body of textual information. To the adult, the information was within the text and the other media merely provided reinforcement and enhancement of that text. In fact, the information, although complementary, was often different. This was rarely appreciated by adults and when appreciated, it was generally considered subsidiary in value to the text.

Teachers' concentration on text was in marked contrast to pupils, who were often observed to use the text as the 'final resort' for information! In searching for an explanation for this difference, the researcher considered the cultural experiences of the two groups. Although pupils were less skilled in traditional 'text-based' culture, they were perhaps more skilled in the use of other media than their teachers. Unlike adults, many children were experienced video/computer games players; television, plus music on CD, provided most with their primary source of entertainment, as well as information. Heppell (1994) comments on this and also the way that children flick between TV channels which he considers analogous to browsing a CD-ROM. Many of the CD-ROMs used were designed for the home/leisure market, often by young adults, who were also more steeped in a computer games, channel-flicking culture than the more formal, 'traditional' print-based culture of mainstream education. Although it may not offer the most time efficient way of selecting information, the researcher felt that the children's unstructured approach to the use of CD-ROMs for information was perhaps closer to the designers' intention than the method suggested by their teachers. It also enabled them to cope with the lack of standardisation in both the organisation of information as well as screen presentation. Many CD-ROMs, particularly those originally aimed at the home market, were found to be organised in quite different ways from books, often lacking all but the most basic index; and unlike early text-only CD-ROMs such material could not be searched like a long piece of text, using key words. Although often visually stunning and appealing to young children, they were designed for leisurely browsing, rather than serious study, and the need for formal indexing and cross referencing was

perhaps not perceived by the designers. There were print-equivalent information books in school libraries, also visually very attractive but less formally organised than older books; indeed some were produced by the same publisher and contained some of the same pictures as the CD-ROMs. Children were observed to search such books for information by flicking through the pages for pictures of the items they wanted information about. This technique could prove successful as the books were often more tightly focused than the CD-ROMs and contained much less information; it was also much quicker, as many book pages could flash past the eye in the time taken for one screen to be downloaded onto the computer.

7.3.3 How did the use of CD-ROMs change through the primary age range?

In both the case study and survey, schools considered that they had a range of CD-ROMs that were accessible to their older pupils but had much greater difficulty in finding suitable material for the younger children. The activities observed and reported to be used by these younger pupils reflected the limited nature of the material available as well as the limitations of the pupils own knowledge, experience and skills. They usually used CD-ROMs with age-appropriate problem solving activities or reading books that were used to supplement similar activities, away from the computer, using traditional materials. By using the CD-ROMs, these young pupils were expected to improve their directional skills to control the mouse pointer and explore 'cause and effect' by clicking on objects. Navigation was usually restricted to turning a page. A printer was not needed, or used for these activities; however, this did mean that there was no record of their achievement.

The multimedia reading books were used throughout the primary age range for introductory activities. Once pupils had acquired simple ordering skills, they would then be introduced to the use of CD-ROMs for information collection. The tasks set were very similar to those using books and pupils were provided with remarkably

similar word cards/ worksheets. the main difference was that the CD-ROM workcards/sheets also included information on the navigation of the CD-ROM itself. This was found to be necessary because most of the CD-ROMs used for this work were designed for leisured browsing at home rather than structured study. Although visually stunning, and media rich, they lacked the standardised indexing and organisation of their traditional counterparts. The record of the pupil's achievement was the completed worksheet, or hand written notes copied from the screen, with the frequent addition of a printout of a favourite screen or picture. The latter was usually mounted by the pupil for inclusion in a topic book or folder.

After a simple introductory activity, such as the use of multimedia reading book, older primary pupils quickly moved to the use of CD-ROMs as sources of information within the national curriculum. These older children had the skills to find information from books with little guidance. However, the result of the non-standard organisation of information was that teachers found it necessary to devise navigation/work sheets for each individual CD-ROM title. Not only was this time consuming, but experience of one title did not necessarily assist pupils in accessing others. Unlike books, there was no pattern or commonality of strategies that could be built up and used to ensure success. Although pupils had potentially far more information at their disposal than ever before, it was perhaps more difficult to access than ever before. This may explain why some schools chose to use only one 'large' CD-ROM encyclopaedia.

When pupils located the requisite information, they took hand-written notes, or copied from the screen, either directly onto a worksheet or into a notebook. These notes were later expanded either by hand or wordprocessed on a class computer, again for inclusion in the pupil's topic work. Some pupils printed pictures, occasionally text, but the quantity and font size of the latter mitigated against its use. Even highly computer literate pupils were not observed to copy to the Clipboard or to disc.

However, at the time of the observations, CD-ROM technology was an emerging technology and developers were still experimenting with its exciting possibilities. This maybe analogous to the introduction of the printing press which also enabled information to be made available to far more people than ever before. Over a period of time, standardised methods of organisation of information books were developed, and conformed to, since it enables users to access the information contained within the pages by the use of standard search strategies. If CD-ROM technology is to be used as a standard and reliable source of information, then a similar standardisation of presentation and organisation of information is needed for future titles. However, the researcher is unaware of such changes nor of Government initiative to produce titles for use within education. Instead, recently announced initiatives focus on the use of the Internet as a source of information. Unlike CD-ROM titles, this is accessed by a relatively small number of search engines where 'traditional' key word search strategies can be used, although the quality and/or veracity of the information cannot be guaranteed.

7.4 What changes have resulted from the use of CD-ROM technology in primary schools?

7.4.1 What changes has their use made to the delivery of the curriculum?

Although there was evidence of schools incorporating the use of CD-ROM technology into their delivery of the National Curriculum, there was no evidence of its use making profound changes to that delivery. Although both schools A and B used a topic approach to the delivery of National Curriculum subjects, there was an interesting difference of approach to the provision of information for staff about CD-ROM titles. School B started from the curriculum; as each Topic Resource folder was updated, information was added about the available CD-ROM titles that might be relevant to that topic for staff to use with their pupils. School A provided staff with a list of CD-ROM titles which included suggestions for Topics and/or National Curriculum targets where the title could be used as well as other information such as interest and reading age.

However, both schools were using the CD-ROMs to enhance their existing delivery of the curriculum, not supplant it. Where CD-ROM titles were used to develop search skills, these were linked to apparently similar work using traditional sources of information such as dictionaries. A range of information sources was also needed as schools generally only had one CD-ROM title for a given subject, plus limited access to a suitable computer, but many books.

The researcher was interested to find that children assumed that any of the large CD-ROM encyclopaedias contained ALL the known information on every subject. When the information they wanted could not be found, they assumed that it did not exist. They did not consider that perhaps the publishers had not chosen to include it, or that their own search method might be at fault. Children considered that they had been successful if they found some/any information on the selected subject. At that time, most of the CD-ROM encyclopaedias were both American in origin and aimed at adult users. Although the CD-ROM frequently provided exciting pictures, sounds and videos, the textual information was frequently inappropriate for primary children.

Since the changes effected by the use of CD-ROM technology appeared to be marginal, its use did not appear to be detrimental to integrated hearing impaired pupils. Indeed, a literate deaf pupil might complete a worksheet more easily than their hearing peers since they used the same primary source of information as the teacher i.e. the text. If nothing else, this achievement could improve the child's self-image.

The technology also appeared to offer original solutions to problems of the education of communication disadvantaged children. More specialised uses of the technology were observed within the unit situation since this provided a higher adult/pupil ration as well as privacy to address a child's individual needs. Teachers were seen to make creative use of commercial products since there were no CD-ROMs produced to

specifically address the needs of the deaf. Thus the same titles were often observed being used in both mainstream and unit classes, but for different purposes.

CD-ROM technology offered the potential to present pupils with information in a variety of media so the individual child could use whatever was most meaningful to them, thus breaking their reliance on adults as sources of information. However, the non-standardisation of the navigation methods and unsuitability of much of the text, meant there was no observed improvement in independence of learning since pupils remained reliant on adult help.

However, the greatest difficulty for these specialist units was in providing their pupils with access to the technology since the small number of pupils and high adult/pupil ratio mitigated against them when competitively bidding for scarce resources.

7.4.2 Did their use change the ways in which pupils collected and recorded information?

When the technology had been introduced to secondary pupils, they had been both expected and able to copy information from CD-ROM and incorporate it into wordprocessed responses. Although very computer literate pupils were observed, no pupil was seen to attempt this operation. In part this was because the CD-ROMs generally only offered the options of copying to the Clipboard or printout and they were using stand-alone systems with limited access time. Another factor was the recording method chosen by teachers. Children were sometimes asked to printout a single picture, as a record of achievement. This was usually stuck into a topic book, in the same way as pupils might have, in the past, traced or copied picture from a book. Pupils were commonly expected to copy information from the screen to a notebook, just as they did when using reference books. This information was subsequently transcribed to 'best copy', either using handwriting or simple typing/word-processing.

7.5 Summary

The findings of the research can be summarised as follows:

1. Many of the same problems that were reported by researchers of previous government technology innovations, were found to have recurred with the CD-ROM initiative. The cascade method was used, as before. There was insufficient time allocated for initial training for most IT co-ordinators to acquire the confidence and competence to cascade information to other staff. Since the initiative was technology-led, not curriculum led, training focused on this aspect. Where schools were unable to discover curriculum applications for themselves, the technology was little used.

2. The most important factor influencing the use of the technology within a school was the priority placed on the use of IT by the headteacher.

3. When introducing the technology, most schools have only one system and must make decisions concerning three interlinked factors: Where it is to be placed, who will access it, and for what purposes? There appeared to be no ideal solution that fitted all school situations.

4. Placement of the system could be influenced by the architecture of the school, teaching style but also the need to demonstrate its availability to a wider audience.

5. Centrally placed systems could be more readily accessed by a larger number of pupils but were less easy for staff to observe and monitor. Those operated within classrooms were more easily monitored by staff but could provide distracting to pupils.

6. Where the use of the technology was restricted, a small number of pupils could acquire more in-depth use and understanding of the technology but the

innovation had less impact on the school as a whole. This approach could affect decisions concerning subsequent purchasing.

7. Pupils were introduced to the technology using CD-ROMs, such as multimedia reading books, that were both exciting and simple to use. As with previous innovations, staff and pupils subsequently accessed the technology when it offered solutions to a perceived need, usually within the framework of the National Curriculum.

8. Teachers perceived the technology as offering a source of information to complement, not supplement, books and that pupils needed to learn a range of age-appropriate search skills in order to access this information. They based both the search techniques and their work cards/sheets on those used with traditional sources of information. However, the idiosyncratic organisation and indexing of many of the CD-ROM titles meant that search skills were taught for each title.

9. Faced with information presented in a range of media, teachers and pupils reacted differently. Teachers were skilled users of text and used this as their primary source. Pupils were more experienced users of mixed media; they used pictures (icons) or speech in preference to text. Neither group appeared aware of this difference.

10. The results of the use of CD-ROM technology were incorporated into classwork in the same way as that from traditional sources, generally by the use of traditional recording methods. This fact, combined with limited access resulted in very little change being observed in the delivery of the curriculum due to its use.

11. Although teachers recognised the potential of the technology for hearing impaired pupils, there was an absence of materials specifically designed to address their needs as well as great difficulty for specialist units to obtain the necessary

hardware. Where this was possible, the greater adult/pupil ratio of the unit setting enabled creative use to be made of commercial titles to meet individual needs. However, the potential for independent learning was reduced by the non-standardised organisation and indexing of many CD-ROM information sources.

7.6 Future uses of multimedia technology

All of the schools, both surveyed and studied, were faced with the problem of limited access for pupils to their multimedia system or systems. Various solutions were tried and although they may have been the best solution in an individual situation, none of them appears to offer a universally applicable 'best solution'. Formal timetabling provided pupils with certainty of access to a multimedia system at a specified time each week; however, this might not coincide with need, nor provide the optimum duration for a particular task to be completed. Less formal arrangements could be more flexible in terms of time required to complete tasks but might depend on teachers also perceiving the need and importance of fitting the task into an already crowded curriculum. A solution might appear to be the provision of many more multimedia systems. However, at the time of the observations, the educational culture was becoming more formal and stressed the importance of the production of evidence of pupils' high achievement in 'traditional' subjects, especially literacy and numeracy. The researcher felt that it was difficult for schools to apportion large sums of money and lengthy periods of time to the use of technology whose essence appeared to run counter to this philosophy.

This tension between the traditional and innovative was also seen in the use of traditional text-based tasks and worksheets, requiring traditional responses with innovative, multimedia sources of information where traditional searching methods were not always appropriate. When embarking on this project, the researcher had expected the use of CD-ROM technology to make changes in the way that the curriculum was delivered which were not borne out by observation. However, the delivery of the curriculum had not changed because neither the tasks set by teachers

nor the recording method used by pupils had changed. Indeed, the researcher often felt that although the children always enjoyed using the CD-ROMs, they would have been better able to find the requisite information by using a book, or better still, several books!

Although schools considered that the CD-ROMs offered 'better' and 'different' information that previously possible, they had not considered the need for 'better' and 'different' tasks and recording methods. Heppell (1994) argued for a reappraisal of multimedia technology that seeks to recognise and value the emergent capabilities of the learners. The researcher agrees with his view that real change is unlikely to occur whilst schools try to deliver old learning outcomes with new technology; instead they should seek new learning outcomes that can only be delivered by that new technology. However, such changes may not be possible without making changes to the design of schools and their delivery of the curriculum, such as those pioneered in the schools reported by Petersen (1995) and Marcus (1997). In a time of restricted funding and emphasis on high standards of achievement this may appear unlikely. However, recent proposals by central government have not only emphasised the achievement of higher standards but also that business should be encouraged to take a larger share in the running of schools. These innovative ICT-rich schools are both commercial ventures by financial consultants and report much higher than average achievement by their pupils in traditional tests. Press reports indicate that this educational innovation can be expected in Britain in the near future.. If successful, it could influence central government to the idea that high standards in traditional areas such as literacy and numeracy can be achieved through the innovative use of technology - which might herald major changes in the way that the possibilities offered by the use of multimedia technology are used within the mainstream of British education. The researcher eagerly awaits an opportunity to research this exciting innovation.

Bibliography

Abbott C, (ed.), (1995), *IT Helps, Using it to support basic literacy and numeracy skills*, Coventry, NCET.

Adams N and Wild M, (1995), *Journal of Computer Assisted Learning,* vol 13, no.2:119-132

Adams N, (1995), *The effect of CD-ROM storybooks on primary students' attitudes to reading.* Unpublished M.Ed Thesis,. Edith Cowan Univ,. Perth.

Aiken N, (1994), 'Teaching and learning with a CD-ROM', *Microscope Multimedia Special*, Summer 1994:30-32

Bailey K D, (1978), *Methods of Social Research*, New York, Collier-Macmillan.

Barnes R, (1995), *Successful study for degrees*, London, Routledge.

Bennett C, (1994), 'Reconceptualising Staff Deveolpment for Technology Diffusion', *Journal of Information Technology for Teacher Education* Vol 3 No. 2 Triangle

Borg W R, (1963), *Educational Research: An Introduction*, New York, Longman.

Boyd-Barrett O, (1990), *Schools computing policy as state-directed innovation,* Educational Studies 16:169-185

Brown J and Howlett F, (1994), *IT Works*, Coventry, NCET.

Busch D, (1994), *Que's 1995 CD-ROM Buyers Guide*, Indianapolis, Que.

Cohen L and Manion L, (1981), *Perspectives on Classrooms and Schools*,.Eastbourne, Holt-Saunders.

Cohen L and Manion L, (1994), *Research Methods in Education*, London, Routledge.

Collins J, Longman J, Littleton K, Mercer N, Scrimshaw P, Wegerif R, (1995), *CD-ROMs in Primary Schools; An Independent Evaluation*, Coventry, NCET.

Collins J, Longman J, Littleton K, Mercer N, Scrimshaw P, Wegerif R, (1996), *CD-ROMs in Primary Schools; An Independent Evaluation,* (Evaluation Summary), Coventry, NCET.

Copley J V and Williams S, (1993), 'Systematic Classroom Observations of Technology Use', Waxman H and Bright G, *Approaches to Research on Teacher Education and Technology* (Society for Technology and teacher education Monograph series), Charlottesville; Association for the Advancement of Computing in Education.

Coupland J, (1994), 'A book has a front,a middle and an end - a CD-ROM goes round and round', *Microscope Multimedia Special*, Summer 1994:32-33

Crook C, (1994), *Computers and the collaborative experience of learning*, London, Routledge.

Denzin N K, (1970), *The Research Act in Sociology: A theoretical Introduction to Sociological Method*, London, The Butterworth Group.

Department of Communications and Arts, (1993), *Creative Nation; Commonwealth of Australia Report*, http://www.nla.gov.au/creative.nation.html

DfEE, (1997), *Review of software for special educational needs*, compiled by Vincent, T, Open University. (restricted circulation to contributors)

DfEE, (1997), *Excellence in Schools*, http://www.open.gov.uk/dfee/wpaper

Disney J, (1996), *A Parent's Guide: Computers Supporting Homework*, London, PIN.

Drage C, (1996), 'Dictionaries and Thesauruses', *Educational Computing and Technology*, September 1996 vol 17 issue 4:29 -32

Edelson S M, (1995), *Stimulus Overselectivity: Tunnel Vision in Autism*, Centre for Study of Autism, Salem, Oregon, www,autism.org/si.html

Edwards A and Talbot R, (1994),*The hard-pressed researcher: a research handbook for the caring professions*, Harlow, Longman.

Elko L, (1993), *CD-ROM Today*, Greensboro NC, GP Publications.

Elliott J and Adelman C, (1976:74), 'Innovation at the Classroom Level: a Case Study of the Ford teaching project', *Unit 28 OU Course E203 Curriculum design and development,*. Milton Keynes; Open University Educational Enterprises.

Gadda G, (1991), 'Writing and Language Socialisation Across Cultures', *With Different eyes: Insights into Teaching Language Minority Students Across Disciplines.* Los Angeles, CA: Univ of Calif pp 55-74

Galton C,(1978), *British Mirrors*, Leicester; Univ of Leicester School of Educ.

Goffman E, (1961), *Asylums*, Harmondsworth, Penguin.

Hall N, (1987), *Th Linguistic and Social Background of Emergent Literacy*, London, Hodder and Stoughton.

Harris T, (1993), *CD-ROM World*, Westport CT, Mecklermania.

Heppell S, (1994), 'Multimedia and Learning: Normal children, normal lives and real change', *Computer Based Learning;Potential into Practice* ed. Underwood J, Lonon, Fulton.

Hinton P, (1994), 'CD-ROMs - the children's view', *Microscope Multimedia Special*, Summer 1994:25-26

Hoinville G and Jowell R, (1978), *Survey Research Practice*, London, Heinnemann Educational Books.

Hopkins D, (1993), *A teacher's guide to classroom research*, Buckingham, Open University.

Howarth M, (1997), 'How real children look at multimedia', *British Journal of Educational Technology*, vol 28, number 2, pp. 125-133

Jones C, (1986/7), 'The Listening Eye', *Learning to Cope:- Computers in Special Education Year book 1986/7,* EMAP, London pp. 46,47

Jones C, (1990), 'Interactive learning - the way forward', *Soundbarrier* June *1990*

Kaplan R.B, (1966), 'Cultural thought Patterns in Intercultural Education', *Language Learning*, 16:1- 20

Kenny J, (1991), *CD-ROMs in Schools. Using the news*, NCET, Coventry.

Maddux C, (1993), 'Past and Future Stages in Educational Computing Research', Waxman H and Bright G, *Approaches to Research on Teacher Education and Technology* (Society for Technology and teacher education Monograph series) Charlottesville; Assn for the Advancement of Computing in Education.

Mallinson P (ed.), (1995), *PC-Kids*, Bournemouth, Paragon Publishing.

Mann B L, (1995), 'Shifting attention in multimedia: Stochastic rules, design principles and the SSF Model', *Innovations In Education and Training International* vol 34, no.2:174-185

Mapp L, (1993), 'Multimedia and interactivity', *Envision*, vol1:2-3, Coventry, NCET.

Marcus S, (1993), 'Multimedia, Hypermedia and the Teaching of English', *Computers and Language*, ed. Monteith M,Oxford, Intellect.

Marcus J, (1997), *One-room schoolhouse keys into the future*, Times Educational Supplement, Oct 31:54

Marshall D, (1991), *Seek and you will find...fast*, NCET, Coventry.

Matthews D, (1994)a, 'That's Edutainment', *CD ROM Today* vol 1: 53, ed Noonan D, Bath, Future.

Matthews D, (1994) b, 'Arthur's Teacher Trouble' *CD ROM Today* vol 1:54, ed Noonan D, Bath, Future.

Maund D J, (1985), 'Leadership in the primary school', *British Journal of In-Service Education*, vol 11 no 2, Spring 85 :101-3

McDevitt A, (1994), *The applications of CD-ROM in primary schools; a case study*, MSTEC (Middlesex Science and Technology Education Centre).

McKeown S, (1996), 'Circuses of the Imagination', *Envision*, June 1996, Coventry, NCET.

McKeown S and Tweddle S, (1994), *Writing and Learning with IT*, Coventry, NCET.

McKeown S and Thomas M (editors), (1995), *Special edition. Extension to the Cd-ROM in Primary Schools Initiave 1995*, Coventry, NCET.

Monteith M (ed), (1993), *Computers and Language*, Intellect, Oxford.

Mouly G J, (1978), *Educational Research: the Art and Science of Investigation*, Boston, Allen and Bacon

Nash C and Steadman S, (1993), *The needs of CD-ROM Users*, Univ of Sussex, ICAPE.

Nash C, Steadman S, Eraut M, (1992), *CD-ROM in Schools.Evaluation Report*, Coventry, NCET.

NCETa, (1993), *Envision*, vol 1, Coventry, NCET.

NCETb, (1993), *CD-ROM - a matter of access*, Coventry, NCET.

NCETa, (1994), *CD-ROM Titles review*, Coventry, NCET.

NCETb, (1994), *CD-ROMs in Schools Scheme; Evaluation and Development*, Coventry, NCET.

NCETc (1995), *CD-ROM Titles review*, Coventry, NCET.

NCET, (1995), *CD-ROM in Education; Extension to the CD-ROM in Primary Schools Initiative 1995*, Coventry, NCET.

Noonan D (launch editor), (1994), *CD-ROM Today*, vol1, Future Publishing, Bath.

Ordidge I, Quigley M, Waller T, (1992), *Finding the Words (dictionaries on CD-ROM)*, Coventry, NCET.

Orford P, (1995), 'Multimedia on CD-ROM: What is it and can Hearing Impaired Children use it?'; *Focus on Deaf People Conference*, May 1995, London, NCET.

Papert S, (1970), *Mindstorms, Computers and Powerful Ideas*, Brighton, Harvester.

Paulissen D and Frater H, (1992), *Multimedia Mania*, Grand Rapids, Abacus.

PC Pro, (1996), *Ms Oceans*, vol24:208 (unacknowledged article), London, Dennis.

Perzylo L, (1993), 'The application of multimedia CD-ROMs in schools', *British Journal of Educational Technology*, vol 24, no.3:191-197

Pester K, (1993), *Hearing IT*, Coventry, NCET.

Petersen K, (1995), 'Multimedia- changing the way we're learning', *Educational Computing and Technology*, vol 16 issue 5 p 14-15

Phillips N.V., (1990) *Standards for Multimedia PCs*, Multimedia Marketing Council.

Quigley M, (1991), *Searching Effectively (NERIS on CD-ROM)*, Coventry, NCET.

Richards J (ed), (1995), *CD-ROM Today- Kids*, Bath, Future Publishing.

RNIB, (1994), *Access Technology*, ed. Lodge P, London,. RNIB.

Roberts A, (1994), 'Multimedia arrives at Albert Primary School', *Microscope Multimedia Special*, Summer 1994:23-24

Russell T, (1988), *An Investigation into the Introduction of Microcomputers into Four Primary Schools,* unpublished M. Phil Thesis, Middlesex University.

Russell T, (1995), 'IT in education- Where have we gone wrong?', *Computer Education*, vol 81, 2-4

Schon D A, (1971), *Beyond the Stable State*, New York,Temple Smith.

Southworth G,(1993), 'Headteachers as Educational Leaders', *School organisations*, vol 13, no 1:93,1993: 73-87

Southworth G, (1988), 'Looking at leadership; English primary school headteachers at work', *Education* 3-13, vol 16 no 2, Jun 88: 53-56

Sparrowhawk A, (1995), 'Report from a Field Officer', *CD-ROM Titles Review 1995*;6-10, NCET Coventry

Sparrowhawk A, (1996), *The use of CD-ROMs in Primary Schools - Notes for Developers,* Coventry, NCET.

Squires D and McDougall A, (1994), *'Choosing and Using Educational Software: a Teachers Guide'*,London, Falmer.

Steadman S, Nash C, Eraut M, (1992), *CD-ROM in Schools, Evaluation report*, Coventry, NCET.

Steadman S, Nash C, (1994), *CD-ROMs in Schools evaluation and development report*, Coventry, NCET.

Stewart L, Chiang K S and Coons B, Meckler T (editors), (1990), *Public access CD-ROMs in Libraries: Case Studies*, London, Meckler.

Taylor J, (1996), 'Moving into multimedia; issues for teaching and learning', *Innovations in Education and Training International*, vol 33 no. 1

Taylor M, (1993), *Opening Up the Library for Visually Impaired Learners*, Coventry, NCET.

Treadaway M, (1994), 'Multimedia in primary schools', *Microscope Multimedia Special*, Summer 1994:4-8

Tucker N and Timms H, (1989), *Buyers Guide to Encylopaedias*, New York, Simply Creative Ltd.

Vayne J, (1997), 'Opening up the box', *Educational Computing and Technology*, April/May 1997: 38

Vincent T, Taylor M, Colven D (1993), *CD-ROM..a matter of access*, Coventry, NCET.

Vygotsky L S, (1978), *Mind in Society; the development of higher psychological processes*, Cambridge, MA, Harvard Univ. Press (original material published in 1930, 1933 and 1935)

Wald M, (1994), 'Using multimedia with young children', *Multimedia special Microscope Summer 1994,* MAPE

Walker R and MacDonald B, (1976), 'Curriculum Innovation at the School Level', *Units 27 and 28 Unit 28 OU Course E203 Curriculum Design and Development.* Milton Keynes; Open University Educational Enterprises.

Watson D, (1993), *The ImpacT Report; an evaluation of the ImpacT of IT on children's achievements*, London, Kings College.

Webster A, (1988), 'Deafness and Learning to read 1:Theoretical and research Issues', *Journal British Association of Teachers of the Deaf,* (12) 4 1988 pp77-83

Webster A, (1989), 'Deafness and Learning to read 1:Literacy Across the Curriculum', *Journal British Association of Teachers of the Deaf,* (13) 3 1989 pp82-92

Wells G, (1987) *The Meaning Makers; Children Learning Language and Using Language to Learn*, London, Hodder and Stoughton.

Wood D, (1988), *How Children Think and learn;The Social Context of Cognitive Development*, Oxford, Blackwell.

Wray D, (1985), *Teaching Information Skills Through Project Work,* London, Hodder and Stoughton.

Schools Council Curriculum Bulletin no 9 (1981), London, HMSO

Yin R K, (1984), *Case Study Research*, Beverley Hills, Sage.

Appendix 1

Glossary of Terms

ambient sound: term used for the background sound on some CD-ROMs.

CAL: computer assisted learning - a program or series of programs which instruct the learner and then test the success of the learning.

CD-ROM: compact disc read only memory - a small disc whose contents can be accessed very rapidly by a computer through a special type of disc drive. It contains vast quantities of text/graphic and/or sound information on a particular subject. Information can be read or retrieved from the disc, but no new information may be added by the user.

Clip Art: pictures that can be stored on a disc or CD-ROM and incorporated into the user's own work. Some are Public Domain; others need to be purchased.

cognitive development: an individual's ability to think and process information internally

communication aid: a microelectronic device with synthesised speech that can be programmed for and used by a non-speaking user to speak' to other people.

computer: a microelectronic device with a keyboard and VDU that can be used to run programs that process data to fulfill a variety of functions, including word processing, datahandling, using graphics and making music.

concept keyboard: (see overlay keyboard).

congenital hearing loss: hearing loss present from birth

cursor: the point at which information is added to a computer program, when data is entered from the keyboard; sometimes called a caret.

database: a collection of stored and sorted information from which the user can extract a variety of facts, figures and textual information by interrogating it.

data compression: technique enabling much more text, sound graphical information can be stored on a disc or CD-ROM

desktop computer: a microcomputer which can be moved, but is normally used in one location i.e. on a desk or in a computer suite.

desktop publishing (DTP): a text-handling program which has a variety of fonts and can include pictures and diagrams; the text and pictures are contained in boxes, which can be easily moved around the page to be displayed in the most suitable/attractive format.

DfE (DfEE): At the start of the investigation, the government department responsible for education was known as the Department for Education. During the period of the investigation, this was changed to the Department for Education and Employment. Both terms are used within the document, dependent on the name used at the time of the reference.

digital camera: a video/still camera which can be used to capture images of the real world and through a digitiser on the computer, convert them to a format that can be read by the computer.

digitised speech: computer speech that is 'real speech' captured through a microphone and then replayed in a computer program.

disc/disk: a disc of magnetic tape enclosed in a protective cover, on which digital information is stored to instruct the computer how it should proceed; may be floppy/hard/zip.

disc drive: a device to read the information to be sent to or received from the computer, to make it work.

e-mail: electronic mailing system where subscribers can send information to other subscribers through a computer and modem.

emulator: a device or software that allows a computer to pretend it is another kind of computer or to provide a scanning alternative to the keyboard for switch users.

fonts: the style of letters used in a word processor or other program which needs to display text.

framework program: content free program which can be customised by someone who is not a programmer.

grammar checker : program which looks at the syntax of a sentence and makes suggestions if it thinks there are mistakes.

grant maintained school: a school that is non fee paying but is funded directly by the DfEE.

graphical interface: method of operating computers using icons (graphics) instead of typed commands

graphics: pictures on a computer.

hardware: pieces of machinery in a computer system.

hearing impairment: more commonly referred to as deaf. A hearing impaired person is one who experiences some degree of hearing loss. The loss varies greatly and definitions are blurred. The range is often referred to as mild, moderate, severe, profound. The British Journal of Audiology, 1988, 22, 123 defines the range of hearing loss as follows

Audiometric description	dB Hearing Loss
mild hearing loss	20-40
moderate hearing loss	41-70
severe hearing loss	71-95
profound hearing loss	in excess of 95

hearing impaired unit: a class or department within a mainstream school where hearing impaired pupils can receive additional specialist help.

Information technology (IT): all things concerned with the handling and dissemination of materials generated by and for computers and their associated technology.

ITC: (information and communications technology) recently changed acronym for IT to reflect the growing importance of the use of computers for communication i.e. e-mail, internet.

integration: term used for the education of pupils with special educational needs alongside their peers in mainstream classrooms.

Interactive video: a system where a video machine and a computer can work together.

interface: the point where a peripheral can be connected to a computer.

Internet: world wide communications system whereby subscribers can search and send information to other subscribers.

Joystick: a switch, normally used for games, to move the cursor around the screen rapidly.

- **K memory:** Kilobytes -a measure of the quantity of memory available to use in a computer.

keyboard: a deck of switches with specific functions to tell the computer what to do.

keyguard: a metal or plastic cover for the keyboard, which has a hole for each key, designed for poorly coordinated users, to inhibit their hitting the wrong key accidentally.

linguistic development: this refers to an individual's ability to process language and communicate. It refers to both expressive (language output) and receptive (understanding) language.

LEA: The Local Education Authority is a department of the county council responsible for the funding and overall management of schools in their county, apart from grant maintained schools where the LEA is only responsible for the provision for pupils with special educational needs

media-rich: term used to describe software that includes a wide range of different media.i.e. text, graphics, animation, video, sound etc.

menu: most computers and their programs have this facility which displays a range of options from which the user makes a choice of activity.

modem: a device which converts computer information for transmission over the public telephone system to other similarly adapted computers anywhere in the world.

monitor: (see VDU).

mouse: a device with from one to three buttons on the upper surface, depending on the computer, and a ball underneath, which is used to operate some functions on the computer.

MS DOS: Microsoft Disc Operating System is the way PC compatible computers are told how to work. the larger the number following the phrase, the newer the operating system.

Multimedia: term applied to a group of computer technologies where text, graphics, sound, animation and video can be combined in order to convey information and should include at least three of the following: text, still images, computer graphics, animation, audio, moving pictures.

network computer: computer which obtains its programs from a file server which may be in the same building or at a distance and linked via a modem.

on-line: live computer link to other(s) via a modem and telephone.

overlay: a sheet of paper with picture or text information that is placed on an overlay keyboard to indicate to the user which area of the overlay keyboard should be pressed.

overlay keyboard: a device with from 128-256 cells, which can be attached to the computer through user port or serial port to provide a simpler way of giving commands to the computer: Concept keyboard (A4 and A3), Oldham Overlay Keyboard (A3), Universal (A3 arid A4).

PC: Personal Computer: a term originally used for IBM desktop machines, but now applied to any computer that runs MSDOS Software.

port: the point on a computer to which other devices may be attached.

portable computer: a computer system which includes a screen and sometimes a disc drive that are sufficiently compact to carry around. The weight can vary greatly and some are luggable rather than portable.

pre-lingual hearing loss: a loss of hearing before language was acquired. This is often considered to be before the age of two.

printer: a device which can be attached to either tile parallel or serial port to print out materials produced on the computer.

program: the instructions a computer needs to perform various functions arid/or activities.

QWERTY keyboard: the 'normal' keyboard format found on most computers.

RAM: (Random Access Memory): an area of tile computer's memory that can have information stored by the user.

Red Book: the first international standards for computer processors

Rewriteable CD-ROM drive: disc drive for CD-ROM discs that can be re-used by the owner.

RIscOS (Reduced instruction Set Code Operating System): the operating system for the newer Acorn computers.

ROM: Read Only Memory is information on a CD disc or computer that can only be read and not amended by the user.

scan: (a) the cursor on the computer can be set up to move around areas of the screen and then be stopped by a switch action for disabled users;
(b) operation of text or images to make them into a format that can be read by the computer.

scanner: a device to capture photographs, pictures or text and convert it into images that can be read by the computer.

search engine: a short cut facility to look for information on the web.

serial port: the point on the computer where some devices requiring this interface may be attached - some printers, touch window, joystick, some switches.

shareware: software written usually by amateur programmers who allow anyone to sample the software and trust the new user to send them a payment if they want to continue using it.

simulation: a computer program which presents a real-life situation and requires the user to make choices which influence the outcomes in the program. it is particularly useful for rehearsing life skills in a non-threatening environment.

software: programs written to tell the computer how to perform to undertake different activities.

sound card: an adaptation needed to some computers to enable sounds to be heard.

special educational needs SEN: children with special educational needs require additional provision to ensure their access to a broad and balanced curriculum, including maximum access to the National Curriculum

speech synthesIser: a device or software to create computer-speech on computers.

spellchecker: software which scans text for typing errors and suggests alternative spellings. It can help some poor spellers$_1$ particularly if their errors are phonetic.

spreadsheet: a program which can be set up to make calculations and a variety of mathematical processes.

Statement of Special Education Needs: legal document that defines an individual child's educational difficulties and the way in which they are to be addressed.

synthesised speech: computer speech that is created from text typed into the computer, which converts it into a mechanical type of speech output.

total communication: this is a philosophy rather than a method of communication. This approach uses a range of language modes; child devised gestures, formal sign

language; speech, lip reading; finger spelling; reading ; writing; visual clues and residual hearing.

touchscreen: a frame containing a cross net of infra red beams, which when broken by a finger, activates a switch in specially designed software.

touchwindow: a touch sensitive transparent screen which can be placed over the screen of modern computers. the user can access most software by touching the screen. It can also be used as a graphics tablet in conjunction with an art program.

tracker ball: an alternative to the mouse, where the ball is on the upper surface; it may be used with two hands and can be fixed in a suitable position for some poorly co-ordinated users.

windows: an area on the screen of the more modern powerful computers. Several windows can be run on the screen at the same tune, so different programs may be run at the same time, without needing to reset the computer to use each one.

word processor: a program in a computer that allows the user to produce, edit, review and print out written materials.

world wide web: an international information system of computers, databases and information pages linked by modems.

VDU: visual display unit which provides the screen to display information and pictures generated by the computer.

Zip disc drive: an external disc drive with 100MB disc that can be plugged into the printer port and used for storing large quantities of information, especially as a backup facility.

Appendix 2

Postal Survey Booklets

The following pages show the booklets that were sent to schools participating in the postal survey. Each booklet was pre-completed with the school name, address, LEA and responsible member of staff, where known.

(approx)

2. Which year groups have used the CD-ROM system?

USED IT LEAST | | | | | | | | USED IT MOST

3. Is the equipment usually used.....

within the classroom ☐ in a resource/library area ☐

other ☐ ----------

4. How are the children accessing the CD-ROMs?

In pairs ☐ In larger groups ☐ Alone ☐

5. Do you use a printer with the equipment?

YES	NO

If YES, do you print out

Pictures	Text	Other

Are these printouts satisfactory?

YES	NO

How could they be improved?

Title	Used with Year group	Use		Opinion		
		a little	a lot	V Good	OK	Poor
Anglo Saxons						
Busy Town						
Creepy Crawlies						
Information Finder Encyclpdia						
Just Grandma and Me						
Mammals Multimed. Encyc						
Art Gallery						
Dinosaurs						
Encarta						
Musical Instruments						
New Kid on the Block						

7. What features best describe the CD-ROMs that have been most used?
(please add to the list, if needed)

Easy to use	
Fitted in with Nat. Curric Topic	
Wide Range of information	
Used as a reward	

8. What features best describe the titles that have been used LEAST?

(approx.)

2. Which year groups have used the CD-ROM system?

USED IT LEAST | | | | | | | | USED IT MOST

3. Is the equipment usually used.....

within the classroom ☐ in a resource/library area ☐

other ☐ ----------

4. How are the children accessing the CD-ROMs?

In pairs ☐ In larger groups ☐ Alone ☐

5. Do you use a printer with the equipment?

YES	NO

If YES, do you print out

Pictures	Text	Other

Are these printouts satisfactory?

YES	NO

How could they be improved?

Title	Used with Year group	Use		Opinion		
		a little	a lot	V Good	OK	Poor
Creepy Crawlies						
Frontier 2000						
Hutchinson Multimedia Encyclopaedia						
Sherston Naughty Stories						
Photobase - Landscapes						
Photobase - Victorian Britain						
Usborne Exploring Nature						

7. What features best describe the CD-ROMs that have been most used?
(please add to the list, if needed)

Easy to use	
Fitted in with Nat. Curric Topic	
Wide Range of information	
Used as a reward	

(approx)

2. Which year groups have used the CD-ROM system?

USED IT LEAST | | | | | | | | USED IT MOST

3. Is the equipment usually used.....

within the classroom ☐ in a resource/library area ☐

other ☐ ----------

4. How are the children accessing the CD-ROMs?

In pairs ☐ In larger groups ☐ Alone ☐

5. Do you use a printer with the equipment? YES ☐ NO ☐

If YES, do you print out

Pictures	Text	Other

Are these printouts satisfactory? YES ☐ NO ☐

How could they be improved?

Title	Used with Year group	Use		Opinion		
		a little	a lot	V Good	OK	Poor
Creepy Crawlies						
Information Finder Encylc						
Just Grandma and Me						
Mammals Multimedia Encyc						
Art Gallery						
Dinosaurs						
Musical Instruments						
New Kid on the Block						
Planetary Taxi						
Silly Noisy House						
Sitting on the Farm						
Tortoise and the Hare						
World of Vikings						

7.What features best describe the CD-ROms that have been most used?
(please add to the list, if needed)

Easy to use	
Fitted in with Nat. Curric Topic	
Wide Range of information	
Used as a reward	

8. What features best describe the titles that have been used LEAST?

Appendix 3

Readability of Encarta

A large number of formulae have been constructed by psychologists and researchers to predict the readability of text. Three of the most commonly used measures are those of Gunning (FOG) ,McLaughlin (SMOG) and Flesch. Although all three are calculated in different ways, data from the Effective Use of Reading Project , Lunzer and Gardiner (1979), indicates that these three measures combine validity with reliability and ease of use. The following paragraphs indicate the way in which each of these formulae is used.

1. FOG (frequency of gobbledegook) Index devised by Gunning, 1952

1. Take a number of 100 word samples from the text.

2. For each sample, count he number of complete sentences and the number of words in those sentences. Divide the number of words by the number of sentences to give the average sentence length.

3. Count he number of words of three or more syllables in the total sample. Divide by the number of 100 word samples. This gives the percentage of long words in the sample.

4. US grade = (av. sentence length + percentage of long words) X 0.4

5. UK reading level = US grade + 5

2. SMOG (simple measure of gobbledegook) Index

devised by McLaughlin, 1969

1. Count the number of polysyllabic words (three or more syllables) in thirty sentences.(P)

2. Find the nearest square root of that number ($\sqrt{P}$)

3. US Grade = 3 + $\sqrt{P}$

4. UK reading level = US grade + 5

3. Flesch Formula (1948)

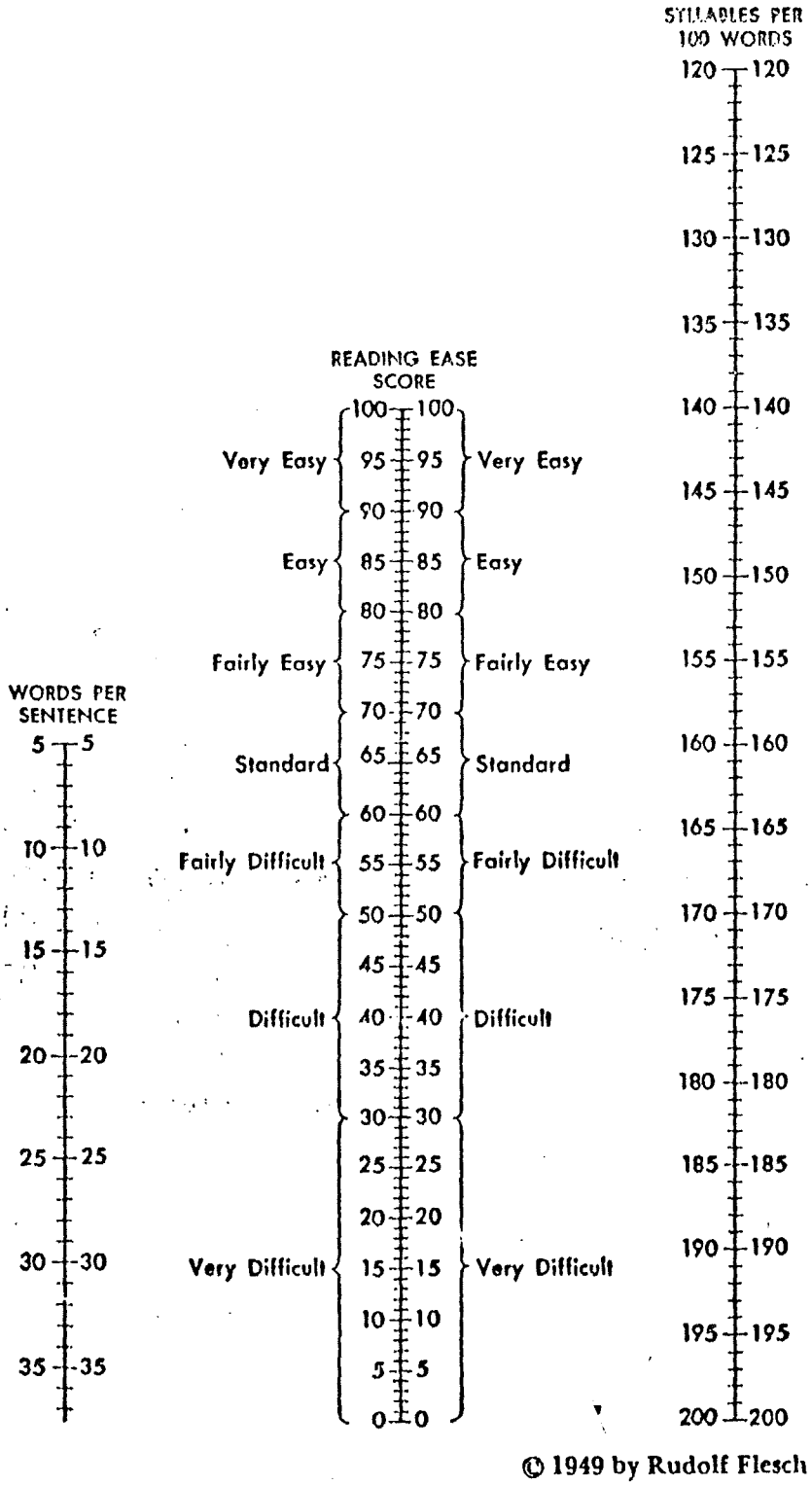
1. Count the number of syllables in 100 words of the text (wl)

2. Calculate the average number of words per sentence (sl)

3. Reading ease score = 206.835 - (0.846 x wl) - (1.015 x sl)

Commonly, wl and sl are calculated by hand and the following nomogram is used to find the reading ease score.

Fig App3.1 Flesch reading ease chart (from Flesch, 1949)



All three methods involve time-consuming counting of syllables, words etc. A recent innovation in the calculation of readability of text is the use of specialised computer programs. Although it is necessary for the sample text to be typed into a standard wordprocessor, these computer programs are able to make the necessary calculations rapidly and accurately. As part of her work, the researcher has made considerable use of Readability, originally programmed by CCH Dawkins but amended by R A Brooking. The software was used by the researcher as part of an unpublished LEA readability project . As part of this work, teachers compared the results of the indices calculated by the software and by hand and found good correlation between the results. Brooking (1990) considered that the Flesch formula gave a better indication of reading difficulty because it was not restricted to a limited age range and could be used for general adult reading matter. The researcher felt that this made it particularly appropriate for the calculation of the reading difficulty for Encarta since this CD-ROM was designed for an adult home audience but was being used by primary pupils as part of the 1994 CD-ROM in Primary Schools Initiative.

In calculating the readability of Encarta, the researcher printed out three sections of text, on subjects that she had observed pupils seeking information. i.e. Queen Victoria, clouds and the Moon. Three hundred words from each sample were typed into the wordprocessor, saved and processed by the software. The passage used was chosen not to include long lists of names (as In the start of the article on Victoria) or numbers (the Moon) as this could produce anomalous results. The following results were obtained:

Table App3.2 Reading ease and age scores for Encarta using Flesch, FOG and SMOG

Filename	No. of words	No. of sentences	No. of syllables	Flesch Reading Ease score	Reading age using FOG	Reading age using SMOG
VICT	100	4	154	51.2	20.2	17.9
	100	5	166	46.1	20.2	18.4
	100	5	165	46.9	21.4	19.2
(ignored)	*6*	*1*	*8*	*87.4*	*7.4*	*8.0*
average	**100**	**4.7**	**162**	**48.1**	**20.6**	**18.5**
MOON	100	5	132	74.9	16.6	15.3
	100	4	151	53.7	19.8	17.5
	100	5	141	67.2	16.2	14.9
(ignored)	*34*	*2*	*52*	*60.2*	*16.5*	*15.7*
average	**100**	**4.7**	**141**	**65.3**	**17.4**	**15.9**
FOOT	100	3	153	43.6	23.5	19.4
	100	5	163	48.6	20.6	18.7
	100	4	155	50.3	20.6	18.2
ignored	*10*	*1*	*18*	*44.4*	*17.0*	*15.7*
average	100	4	157	47.5	21.5	18.7

As can be seen, each of the paragraphs used for the examination were slightly longer than 300 words. The last row of figures for each paragraph shows the calculated values for these smaller samples. All are at variance with the calculations on the full samples of 100 words. This is unsurprising since the formulae for the indices assume a sample of 100 words, not less. The researcher therefore has only used the average of the figures for the full samples in the following table .

Table App3.3 Average reading age scores for Encarta using Flesch, FOG and SMOG

Filename	Flesch reading ease score	Reading age using Flesch	Reading age using FOG	Reading age using SMOG
Vict	48.1	15	20.6	18.5
Moon	65.3	14	17.4	15.9
Foot	47.5	17	21.5	18.7
Average reading ages		**15.3**	**19.8**	**17.7**

The variation between the scores maybe explained by the way in which each index is calculated. The FOG index always appears to provide a higher score than the other two methods, However, this index depends on a calculation of the length of each sentence and percentage of 'long' words. Since Encarta is providing factual information, there is a preponderance of technical terms.. Although many of these will be deemed 'long' words, they are words that might well form part of the sight vocabulary of the reader who has some knowledge of the subject. In this way, the researcher feels that this index may give a pessimistic impression of the reading difficulty of the passage. The Flesch and SMOG indices, relying on a measure of syllables in the words as well as the words in each sentence may provide a better guide to the true reading level of the encyclopaedia. However, the scores obtained would be well above the reading age of most primary pupils.

Appendix 4

Data Recording Tables and Diagrams

The following pages show the forms that were used by the researcher to record information during the case study, as detailed in Chapter 3

Form 1	Form used to record the actions and positions of the pupils in the group (Group Dynamics)
Form 2	Form used to record the navigation of a CD-ROM
Form 3	Questionnaire used with pupils
Form 4	Questionnaire used with staff

Form 1 Used to record the actions and positions of the pupils in the group
(Group Dynamics)

Group ***CD-ROM*** ***Date***

Key
1.Operating keyboard
2. Talking related to task
3. Decision making
4. Seeking help
5. Passive but interested
6. Daydreaming/other

7.

8.

9.

Sketch

A	B	C	D	E

Notes

Form 2 used to record the navigation of the CD-ROM

CD-ROM IN PRIMARY SCHOOLS

Date_____ School _____ HI PUPILS_____

Topic_____ CD-ROM Used _____

Age of Pupils_____ Group size_____ Task_____

ITEM	back	Text	Cap-tion	Pic-ture	Video	S'nd	NOTES

Form 3 Questionairre used with pupils

CD-ROM IN PRIMARY SCHOOLS

Date_____ Group_____ School_____

Age of pupil_____CD used_____

Task_____

_____
__

Worksheet_____ Staff present_____

Did you find out the information you wanted?_____

If not, why not
_____

_____
__

Did you print out the information/picture?_____

Reasons for this_____

_____

What did you like best?_____

_____

What did you like
least?_____

_____

Have you used any other CDs?_____Where (home/school?_____

_____

_____

_____

_____

Other comments

Form 4 Questionairre used with staff

Questions for Teachers

1. Which CDs have you used with your class?

2. What was the purpose of the use of the CD?

3. What was the use linked to? Topic? Nat Curriculum? etc

4. Were you able to use the CD yourself before using it with the children?

5. What were you hoping that the use of the CD would offer compared to traditional methods of obtaining information?

6. Were those expectations borne out?

   If not, why not?

7. Were the children given particular task/s using the CD?

   Were these open-ended, specific, was there a choice of task?

8. How did the children use the CD?

   individually? in pairs? group? (how big?)

Form 4 Questionairre used with staff

9. What did children obtain from the CD?

pictures?

text?

notes?

10. What did they use the information for?

11. Did the use of the CD change the learning task ?

12. What problems did you find?

13. What would have made the use of the CD better?

14. Would you use it again?

What changes would you make to the way you use it next time?

COMMENTS

Appendix 5

Examples of the ways in which teachers were informed of the available CD-ROM titles

As explained in Chapter 5, schools A and B provided staff with information on the CD-ROM titles that were available in very different ways.

School A started from the CD-ROMs and suggested areas of the curriculum in which it could be used.

School B started from the curriculum and suggested CD-ROMs that could be used to enhance its delivery.

This appendix contains copies of:-

1. The Information Technology (including CD-ROMs) information for staff in school A

2. An example of a Topic Resource Folder (Forces and Motion) from School B

INFORMATION TECHNOLOGY

A brief description of the packages available Sept 95

OPERATION	USE	YEAR/s
Word for windows	Word processor	all
Excel	Spreadsheet	all
Counter 4 windows	Database	3/4/5
Clipboard	Database	all
Information workshop	Database	5/6
Commotion CoCo	Moving machines	5/6
Roamer	Logo type package	3/4
CD Roms (see separate lists	Multimedia systems	all
Logo	Maths	5/6
Word sound	with Word for Windows	S.E.N
Music	?	all
Paintspa	Art package	all
Smartpics	Art package of instant pictures	all
Kidpix	Art package	3/4
Flying Colors	3D Art on CD Rom	6

C D Roms currently available Sept 95

Please note that some of these CD Roms may not work on the computer which has the separate CD Rom.
Many of the Cd Roms are already loaded to the new multimedia systems .
Please check your front screen before using.

TITLE	SUBJECT	YEAR
Art Gallery	Art understanding and interpretation, including a history	5/6
Classical Music	Musical appreciation including a biography of the musicians	5/6
Vikings	History of the viking era	all
Flying Colors	Art package with excellent graphics	6
York	History and Geog. package covers the full story of York. (difficult)	5/6
The Way Things Work	Science. Describes how things work	all
Information Finder	X-Curricular on all subjects	4/5/6
The Ultimate Human Body	Science/ Biology	5/6
Musical Instruments	Music. Appreciation of instruments	4/5/6
Hutchinson's Encycloped.	X - Curricular.	all
A - Zap	Reading. Games to help + sound	S.E.N
The Rabbits at Home	English. Story approach + sound	S.E.N
Little Monster at School	English. Story approach + sound	S.E.N
Arthur's Teacher Trouble	English. Story with interactions	3/4/
Arthur's Birthday	English " + sound	3/4

Hare and the Tortoise	English " + sound	3/4
Dangerous Creatures	Science/ Biology/ Geography	all
My First Incredible	English/ X - Curricular	S.E.N
Dictionary		3/4
Kingfisher Children's	X - Curricular	all
Encyclopedia		
Exploring Earth Science	Geography / Science	6

USING THE MULTIMEDIA TOOLS SECTION
ON THE NEW MULTIMEDIA MACHINES

To use the Multimedia Tools section click on the icon on your front screen.
This section will allow you to
Play your own CD Rom music even whilst you are working on another application
Use the speech synthesiser
Make your own tunes
Adapt your words or tunes

HARDWARE Sept 95

There are three BBC Masters/128 and B and W printers in use in the Booster Unit, providing adaquate software for children with Special Needs.
There is also a Laptop with Smart installed for some WP work
The majority of the system in the rest of the school runs to a NOVELL NETWORK which runs both student and admin. units. The admin side has two WP's and a Laptop.
every machine has Windows applications
The following configuration currently apply to the school

Base 1 & 2 (6th yrs) two PC 486 nertworked.
one Multimedia CD Rom system with windows.
Two HP 550 or 560 Desk jet colour printers.
One Commotion Box - CoCo.
The Roamer is also kept here.

Base 3 & 4 (3rd yrs) two PC 486 networked
One HP 550 colour printer.

Base 5 & 6 (4th yrs) three PC 486 networked.
Two HP 550 or 560 colour printers.

Base 7 & 8 (5th yrs) three PC 486 networked one of which has a CD Rom system.
Two HP 550 or 560 colour printers
One Archimedes computer

One integrex colour printer

Booster unit
one PC 486 with multimedia system with Word 6 with sound microphone
This unit has a videocard attached to enable video pictures toi be captured and used in Word etc

this section has not been saved

Science Topic Plans **Year A** **N.C. Years 5 & 6** **Topic - Forces & Motion**

Year 6

A.T.1	Programme of study		Knowledge development
Demo: child on skates throwing bag books / pushing against wall. reaction cart ball in water Exp. Dragsters - how far do diff. designs travel - how can alter distance. Demo: Friction - block wood on various surfaces brick on diff surfaces. Exp: Do all materials wear same? design own experiment Use Newton meter to measure force.	Physical Processes- 2f- *that forces act in particular directions* 2g- *that forces acting on an object can balance ,eg in a tug of war,on a floating object, and that when this happpens an object stays at rest* 2c-*about friction, including air resistance, as a force which slows moving objects* 2b- *that objects have weight because of the gravitational attraction between them and the earth* 2h- *that unbalanced forces can make things speed up,eg an apple being dropped, slow down, eg a shoe sliding across the floor, or change direction, eg a balll being hit by a bat* 3a- *that light travels from a source* 3b- *that light cannot pass through some materials , and that this leads to the formation of shadows*		Physical Processes;- Forces and motion • *springs and elastic need a force to change their shape (4)* • *springs and elastic exert a force on what ever is changing their shape (4)* • *weight is a force (4)* • *forces are measured in Newtons (4)* • *forces act in particular directions (4)* • *more than one force can act on an object (4)* • *if the object is not moving the forces are balanced (4)* • *friction is a force that acts against the direction of movement of an object across a surface* • *drag is the force that opposes motion in air or water* • *weight is the force due to gravity acting on an object pulling it towards the Earth* • *if the forces acting on an object are not equal, ie. unbalanced, changes occur - things can speed up, slow down, change direction or position* Light :- • *that light travels from a source (4)* • *light travels through some materials and not others (4)* • *when light cannot pass shadows may be formed (4)* • *we can change the shape of a shadow (4)*

Topic - Forces and Motion

A.T.1	Programme of study		Knowledge development
Demo - light through 2 cards - moved - materials for discovering transparency etc - reflections - using mirrors	Physical Processes 3c - *that light is reflected from surfaces, eg mirrors,polished metals* 3d - *that we see light sources, eg light bulbs, candles, because light from them enters our eyes*		Physical Processes :- Light contd • *we can see ourselves in shiny surfaces (4)* • *our image can be distorted (4)* • *light can be reflected by some surfaces (4)* • *light travels in straight lines (4)* • *moving the light source or object changes the size of the shadow* • *we see light sources because the light from them enters our into our eyes (SAFETY)* • *we seebecause the light entering our eyes sends messages to our brains* ***Related Extension Content*** • *light can be made to change direction* • *imagges can be distorted when viewed through transparent materials* • *we see objects because light from a source is scattered off the objects into our eyes* • *the intensity of light can be detected / measured using sensors* • *light allows us to see colours* • *looking through coloured filters changes the colours we see* • *white light can be split into the spectrum colours*

Comments ;-

Some chn still problems with understanding where force is being applied

Need lots disc. to see where forces in action in 'real' world

TOPIC Forces and Motion **RESOURCES**

Packs	Book sets	Video	C. Ds	Apparatus	Visits	Others
MacDonald Gunn.	Science 5-11 Forces + Structures	Science St 2.	Way things work Information Finder Encyclopedia of Science Encarta	Newton meters.	SATRO Fireworks	

Speaking + listening
Researching Reporting

Spreadsheets - experiment results

- balanced forces
- unbalanced forces
- friction / drag / air resistance
- change of shape

Light - sources, formation of shadows, reflection

History

Development of machines (C.D. Rom).

Technology

Moving models - use either levers / gears / pulleys / wheels / winches - planning stage.

Theme

FORCES & MOTION

Geography

IT

CD's - Way things work
Encyl of Science
Encarta

P.E. and Dance

Gym - Balance / Forces.

Visit

by SMTRO - Forcesticks.

Music

Art

Light + Colour.

Religious Education

Science Topic Plans **Year A** **N.C. Years 5 & 6** **Topic - Forces & Motion**

Year 6

A.T.1	Programme of study		Knowledge development
Demo: child on skates throwing bag books / pushing against wall. reaction cart ball in water Exp. Dragsters - how far do diff. designs travel - how can alter distance. Demo: Friction - block wood on various surfaces brick on diff surfaces. Exp: Do all materials wear same? design own experiment Use Newton meter to measure force.	Physical Processes- 2f- *that forces act in particular directions* 2g- *that forces acting on an object can balance ,eg in a tug of war,on a floating object, and that when this happpens an object stays at rest* 2c-*about friction, including air resistance, as a force which slows moving objects* 2b- *that objects have weight because of the gravitational attraction between them and the earth* 2h- *that unbalanced forces can make things speed up,eg an apple being dropped, slow down, eg a shoe sliding across the floor, or change direction, eg a balll being hit by a bat* 3a- *that light travels from a source* 3b- *that light cannot pass through some materials , and that this leads to the formation of shadows*		Physical Processes;- Forces and motion • *springs and elastic need a force to change their shape (4)* • *springs and elastic exert a force on what ever is changing their shape (4)* • *weight is a force (4)* • *forces are measured in Newtons (4)* • *forces act in particular directions (4)* • *more than one force can act on an object (4)* • *if the object is not moving the forces are balanced (4)* • *friction is a force that acts against the direction of movement of an object across a surface* • *drag is the force that opposes motion in air or water* • *weight is the force due to gravity acting on an object pulling it towards the Earth* • *if the forces acting on an object are not equal, ie. unbalanced, changes occur - things can speed up, slow down, change direction or position* Light :- • *that light travels from a source (4)* • *light travels through some materials and not others (4)* • *when light cannot pass shadows may be formed (4)* • *we can change the shape of a shadow (4)*

Topic - Forces and Motion

A.T.1	Programme of study		Knowledge development
Demo - light through 2 cards - moved - materials for discovering transparency etc - reflections - using mirrors	Physical Processes 3c - *that light is reflected from surfaces, eg mirrors,polished metals* 3d - *that we see light sources, eg light bulbs, candles, because light from them enters our eyes*		Physical Processes :- Light contd • *we can see ourselves in shiny surfaces (4)* • *our image can be distorted (4)* • *light can be reflected by some surfaces (4)* • *light travels in straight lines (4)* • *moving the light source or object changes the size of the shadow* • *we see light sources because the light from them enters our into our eyes (SAFETY)* • *we seebecause the light entering our eyes sends messages to our brains* ***Related Extension Content*** • *light can be made to change direction* • *imagges can be distorted when viewed through transparent materials* • *we see objects because light from a source is scattered off the objects into our eyes* • *the intensity of light can be detected / measured using sensors* • *light allows us to see colours* • *looking through coloured filters changes the colours we see* • *white light can be split into the spectrum colours*

Comments ;-

Some chn still problems with understanding where force is being applied

Need lots disc. to see where forces in action in 'real' world

TOPIC Forces and Motion **RESOURCES**

Packs	Book sets	Video	C. Ds	Apparatus	Visits	Others
MacDonald Gunn.	Science 5-11 Forces + Structures	Science St 2.	Way things work Information Finder Encyclopedia of Science Encarta	Newton meters.	SATRO Fireworks	

inning Sheet- .....

			Experiments
4th - 5th Jan.			
8th - 12th Jan	Forces - ideas. Balanced forces	Action + Reaction - Tug of war - Floating.	skates / cart ✓ Dragsters Boat designs ✓
15th - 19th Jan	Unbalanced forces - slowing down friction, air resistance, drag Measuring - Newtons	Friction (reducing friction) Air Resistance Drag / lift	- brick on diff surfaces ✓ paper + spinner pyramid parter card / kite ✓
22nd - 26th Jan	Unbalanced forces - speeding up - changing direction - changing shape		- balloon collapsing ✓ - dropping plasticine
29th Jan - 2nd Feb	light - how it travels where it travels - shadows.	sources - travels through some things not others - shadows	which materials will light pass through ✓ - altering size shadows
5th - 9th Feb.	Reflections light source + seeing	reflection + distortion. travels in straight lines. - light entering eyes message → brain.	✓

Date	Writing	Speaking	listening	Drama	Reading	SRA
	Completion of Reading Passport	Presentations	Uncanny Stones - UFD			
	(Synonyms). 'Come back' - story.	Presentations Y6 - Interests	Uncanny Stones.	- Interpretation in Dance"	Reading groups. J.B - Direct Instruction	
	Railway Essay Competition 'What I would like to be when I grow up.		Uncanny Stones contd "	"	"	Research lab ↓
			contd. "	"	"	
	Poetry - Haiku.	← Visit to	contd. " Jungle Book →	"	"	
	Hearts Write Competition Poem - Alone		"	"	Reading task - good beg. + endings. "	
Obj.	Consideration of ways improving written work - plan/redraft - diff forms written work.	- express ideas confidently, coherently - participate freely in discs -	- development listening/recall skills - follow complex instructions	- ability to interpret music with more confidence	- increased fluency/ expression - ability to interpret/ respond to - use skills.	- increased info. handling/ research skills
Asses.	Product Discussion	Speeches Discussion	- observation - ability to carry out instructions	Performance.	in research Observation Discussion Product of research.	- Product Discussion

	Handwriting		Superspell / Spellings		English worksheets / Grammar	
Date	Y6	Y5	Y6	Y5	Y6	Y5
4th - 5th Jan					14 dictionary skills. - speech marks.	16. dictionary skills.
8th - 12th Jan	p27. The Comma Growing - clumps, layouts.	Home poem.	Bk 5. p17 prefixes. list	Bk 4. p14 prefixes un/dis/in/im	15 verbs -past tense Synonyms.	17 adjectives
15th - 19th Jan	Too many cooks spoil the broth	Night	p18 ai ae r + extras	p15 or/oy/ur/al/ ay	16 directions	18 adjectives + nouns
22nd - 26th Jan	Many hands make light work	Snow for a week	p19 oa oo ou au +r + extras	p16 ur/ er	17 idioms	19 adverbs
29th Jan - 2nd Feb	Dont put all your eggs in one basket	November Night	p20 ea ee ei ie +r + extras	p17 aw or	18 pronouns verbs/ adverbs	20 apostrophe
5th Feb - 9th Feb	A stitch in time saves nine.	Hippopotamus Poem	p21 de ex exc list	p18 ch	19 joining sentences	21 anagrams
Obj.	fluent, controlled hand using italics nib.	fluent join correctly formed letters	recognition of spelling patterns/ letter strings/ phonic blends / digraphs		Use punctuation marks, recog parts of sentences ability to use dictionary	
Asses.	Product	Product	Ability to attack unknown words when reading. Attempts at written work Spelling tests		- Written work. Exercises - use / observ research skills	

Mathematics Mental Science

Date	Y6	Y5	Anthmetic	Tables.	Y6	Y5
4th-5th Jan	Data-handling p120-121	Averages. p121-2	Y6 Bk 4 2.1 Y5 Bk3 2.1.	2+4 mixed x/÷		
8th-12th Jan	Probability p123-4	Probability p122-4	2:2.	3+6 mixed	Forces- Balanced forces Action/Reaction.	
15th-19th Jan	p125 Percentages p52 + Wkbk.	p125 +/- HTU. p28-29	2:3 gps. a/b/c.	4+8 mixed	Unbalanced forces. -friction/drag air resistance	
22nd-26th Jan	p13→14 p53 Decimals p36.	p30-33 Division. p34	2:4. gps a/b/c.	4+10 mixed	-Ear flowers. - speeding up - slowing down - changing shape.	
29th-2nd Feb	a) p37-40 b)	p35-37.	2:5 gps. a. ab abc.	5+9.	Light- how it travels shadows.	
5th-Feb-9th	p44-43 Wkbk 10	p37-39. Fractions		5+10	Reflections how we see.	
Obj.	-Collect/record/ alter data -develop understd probability +vocab. -calc percentages. -use 4 operations with decimals	-develop understd probability +vocab. - consolidate knowledge division facts.	Applic of math. knowl - mental problem solving.	Rapid recall.	Knowledge + Understanding of. Forces Light Opportunity to test, measure, observe.....	
Asses.	Oral Product Check-ups	Disc. Product Check-ups.	Product Discussion	Tests.	Product Oral —	

Geography

Date	History	Y6	Y5	PE	IT	Art
				Gymnastics Gym(kc) Balance Movement Body Parts	Starting Grid. Excel ↓	Silhouettes
	Tudor Documents			Movement Dances diff countries 1) Caribbean	logo- Co-ordinates Hyperstudio Info Wkshop. DS- Way things work The way it works Enc. of Sc Encarta ↓	Bluepoint pictures
	"			↓		Shiny paper pics Reflected pics. Day + Night
					Infdl. Wakshop ↓ Word Proc ↓ Graphics	Pastel/ ↓ Chalk/ Water cols.
		Settlements ↓ rural/ urban reasons for.			↓ " .	Printing. ↓ ↓ Sketching - faces/ houses.
		develop. " .			↓	↓
Obj.	- use + evaluate sources	- knowledge + underst re size/ develop of settlements		- improve skills - throw/hitting/ passing etc - team comp - control movement - respond to music	- communicate + handle data - use variety programmes confidently	- use range materials/ techniques - record observations
Asses.	Discussion Product.	Product Disc.		Observ.	Product Disc.	

Collective

Date	Music	RE	Worship	Technology		
4th - 5th Jan.		Y5 + Y6				
8th - 12th Jan.	Rhythm Pulse Beat	Ideal friends.	Trust			
15th - 19th Jan.	listen + compose Rhythm Pulse, Beat.	Choosing friends - Leader of Gang	Revenge			
22nd - 26 Jan	compose + listen to add metre - beats in a bar	Jesus friends Disciples.	Chinese N.Y			
29th - 2 Feb	speed to music	James + John - Coming things up.	Pilgramage Journeys.	Moving models. - Planning started.		
5th - 9th Feb.	metre to listen + compose speed to MUSIC	Doubt + Forgiveness.	Important Holy Places.			
Obj.		- explore relationships - investigate greetings / behaviour - explore age way religions		- using simple mechanisms to produce movement. - generate + develop ideas - select tools /	materials.	
Asses.		beliefs influence relationships — Oral Product Observation.		Discussion Product		

Appendix 6

Use of CD-ROM with an individual autistic, deaf child for communication.

John is both deaf and autistic. He is now in year 2 but started attending the unit of school D as a pre-schooler in the attached nursery. Although his hearing loss was not thought to be severe, John did not establish communication at home despite advice and assistance from a peripatetic teacher of the deaf. He therefore began to attend the integrated deaf/hearing nursery class at about three years of age but still did not communicate with either adults or children. By year two, he still has virtually no communication with people but can, and will choose to, communicate with a computer. It was via the class computer that he began to react to the world. When he started in the unit, he just did not react at all to attempts to establish communication although he has considerably more hearing than most of the children. He could sign and speak a little but it all **meant** nothing. At that stage he was believed to be 'deaf only' although unit staff wondered if he had additional problems because he just did not present as a 'normal deaf child' and the strategies that usually established communication with such children had no effect on John.

Computers are used considerably with the children in the unit but, unlike the other children, John could do nothing with the usual programs. He could not understand how to use the mouse or keyboard but yet did not appear to be unintelligent. In desperation, the head of the unit sought advice from the researcher in her role as SEN IT adviser. The researcher found that John was able to interact with a touchscreen and simple cause/effect software which she was able to provide on loan from the LEA SEN Support Service (approx. 18 months before the current observations). This 'worked' very well and he progressed to more complex matching and sequencing tasks, painting with his finger, starting to use the other infant software and can now use a mouse, assemble pictures in My World and respond to some extent to some children. However, he is still a very strange little boy, locked into his own world. He can be very violent on the playground to other children if they don't follow the rules. e.g. he was found hitting another child's head on the

playground because the child had not done as they had been told! He cannot cope in situations where there is too much stimulation and/or excitement. He will sometimes go and hide his head in his coat or need to sit quietly in a corner on his own for a while. Since he has been in the unit, John has been considerably tested and finally diagnosed as Autistic by a national medical specialist - however, this diagnosis is not, as yet, accepted by the educational psychologist of his LEA!

John perceives the researcher as the person who brings computer things for HIM and always comes up to her when she enters the unit. He stands or sits next to her and will sometimes shrug his shoulders - which is the nearest he can get to a greeting- and to receive this shrug is a considerable honour! Although he does not show emotion, he appears comfortable in the researcher's presence and wants to use the computer if she is there and will show her what he has found on the CD-ROM.

During the period of the case study, some other strategies had been tried with him, using IT. If John is asked to say, 'draw a house', he may well draw anything. Although he understands the sentence 'draw a house', he does not understand that he is then expected to draw a house, not a dog or anything else! Once, when he got it 'right' and was praised for his work, he drew the same thing every time he was asked to draw! The drawings themselves are quite detailed with good pencil control; it is communicating the subject matter where problems occur!

The head of unit learnt of the preference for a reduced range of stimulation by some autistic people from a member of NCET staff who was working on a project with such pupils. She had noticed that when John draws on paper he always chooses to use pencil only. He does not use more than one or two colours if using paint or the computer. As she had also noticed John's tendency to hide in a dark place when things became too much for him, she decided to try this reduced stimulus strategy. The work of the class was based around the story of Jack and the Beanstalk which had been told to them. The other children were retelling the story in whatever way

was appropriate to them. She offered John an art package, but with the pencil tool, and asked him what happened first - he drew Jack and the cow. She then went on to ask him for the next part of the story. To her amazement, he not only knew what came next but drew it. Eventually, he had produced a series of pictures, vividly illustrating the story. She then linked them into a slide show and showed it to him. He showed as much emotion as he has ever shown on seeing it and likes to look at it over, and over again. This represented something of a breakthrough with him and there now appears to be a means where he can communicate his ideas.

John watched with interest when the CD-ROM computer arrived in the classroom. As it was brought by the researcher, he assumed that it was for him and immediately wanted to use it. It was difficult, at first, for him to understand that other children could also use it! The following paragraphs describe his use of the CD-ROM, A Silly Noisy House and is taken from transcribed notes.

Silly Noisy House 1

Group of 2 Yr1/2 children in the class room but not formally supervised. Their teacher talked to them first and they were given the task to explore the program.....

They started in the hall, then went upstairs to the attic.There was much signing and talk about what to do. They clicked on various things - Jack-in-the box first. They knew what to expect to happen but enjoyed it the same! They clicked on various things and jointly decided to go somewhere else.

They went to the piano. They clicked on one thing which gave music icons - one child could hear this a bit, resulting in lots of communication with the other one.

They then decided to go back to the attic, click around and then back to the door.

They moved around the house to other rooms and clicked on things they thought would produce effects. e.g. cuckoo jumped out of clock and they joined in with the noise.
They moved into the basement and found the bottles. Together they found the 'magic bottle'. They changed over the mouse control quite often. These children were used to both a mouse and working on computers. The CD-ROM held their interest for quite a long time but staff kept an eye on them and after a time they changed to another activity in the classroom.

Whilst this was going on, John came up and watched. He started pointing to things and showing an interest in what they were doing - which is unusual for him.
He watched the other children using A Silly Noisy House and tried to push them off - which is his way of asking to have a turn! Although this CD-ROM has both sound and pictures, the colours are not bright and seem to be acceptable to him. There is no ambient sound so the only noise is part of an 'effect'.

John started to use this CD-ROM alone and soon found things the other children did not. He went into the coat cupboard - where he goes himself when confused, perhaps over-stimulated- and discovered how to get the skeletons to appear. He is used to dragging pictures in My World and tried to drag the skeletons out of the cupboard. They wouldn't go! He went back into the Hall and back in the cupboard several times! He subsequently visited this every time he used the CD-ROM.

John then went to the bedroom and like most children clicked on things. He discovered that he could put the light on and off. He then found the magic wand and the sequence to get a dream and wipe the cloud to see the dream. No other child found this sequence as it is quite complex. He did this every time he used the CD-ROM and even showed other children how to do this. However, they forget, he doesn't. This was his 'favourite' part of the CD-ROM but he couldn't explain to us why. When using this CD-ROM, he concentrates intensely on the screen and will make

noises, sometimes as a reaction to effects or actions, although he never smiles, laughs or shows any emotion.

The second time he used it he let another child sit by him. The other child started pointing out things for him to click on - which he did! After adult intervention, they swapped mouse control and John started pointing. He then showed the child how to make the dream by pointing and making noises and nodding when they got it right. This was co-operation on a new scale for John. This 'opening out' by him was used by staff to encourage communication. Over a period of time, he became established as the CD-ROM expert by the other children. It was the activity he would always chose and if staff gave another child the mouse, he would try to communicate with them. This was video-ed by the researcher. She had hoped to use a eyeball camera to capture the children's faces and a standard video camera to capture the effect on screen. Unfortunately the eyeball camera stopped working as soon as the CD-ROM loaded due to lack of memory. The compromise was to video some work on the screen and other parts on their faces and just note what happened.

The other CD-ROM used in the unit was **Amanda Stories.** These are simple line drawings and again John found them acceptable. There are no words in the 'stories' but if you click in the right places, the story emerges. The children soon discovered how to load stories from the menu page -and how to end them too, for the others often became frustrated when they could not move on to another page. John did not, because he discovered the 'right' sequence for each story and, with his fondness fro rituals, would repeat it again and again! One of the stories had a particularly complex sequence but he remembered it each time. He started showing others what to do but they did not remember as he did. Staff felt that the stories were so far outside their experience that they did not really understand them. Despite a probable lack of comprehension of the meaning of the story, John recalled the sequence accurately.

Staff felt that A Silly Noisy House was useful with all the children but Amanda Stories much less so because it was essential to get the sequence right. Many of the other children gave up after a few tries and would quit and try another! Staff then noticed that John had worked out how to quit from EVERYTHING and reload! A Silly Noisy House was a CD-ROM they felt to be very helpful because it was completely open ended, encouraged communication, learning simple sequences and everyone could find something they liked and could enjoy success. Different children discovered different things and would communicate them to others. As there were no words or spoken instructions, none of the children was at a disadvantage, although some did not understand the activities that relied on sound. However, they just seemed to ignore these once they had found that they 'did nothing' - for them! Staff felt that one of the important things shown through the work with the CD-ROMs was that John has a communication, not a learning, problem and their use has opened up ways of helping him to communicate.